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A Collection of Artifacts from Pence-Duerig Cave in South-Central Idaho

by Ruth Gruhn

I. INTRODUCTION

A. Location and description of the site.

This paper describes a collection of artifacts from Pence-Duerig Cave, (Site 10 JE 4), an archaeological site located in south-central Idaho in a box canyon along the north rim of the Snake River Canyon. The site is located in the southern part of Jerome County, in Section 33, Township 9 S (Boise Base Line), Range 18 E (Boise Meridian). It is at approximately 43°35' North Latitude and 114°18' West Longitude.

Pence-Duerig Cave is in a large deep alcove called the Devils Corral in the basalt rimrock of the Snake River Canyon about seven miles northeast of the city of Twin Falls (see map, Fig. 1, A). This box canyon is evidently an old tributary channel into the Snake River. The Devils Corral is fairly large. It runs back in a northeast direction from the Snake River Canyon about one mile, and is approximately ¾ mile across at its mouth. The mouth of the canyon is nearly 200 feet above the present level of the Snake River, which is here almost 3300 feet a.s.l.; and the rimrock of the canyon rises above the canyon floor to a maximum elevation of approximately 3700 feet a.s.l.

In general the north rim of the Snake River Canyon in this region is dry lava desert country, with xerophytic flora. In the Devils Corral moist conditions afforded by ponds and springs in the lower part of the canyon have resulted in a relatively lush environment with grass, trees, and shrubs; but the upper part of the canyon, higher and relatively dry, is now dominated by the European import cheat grass (**Bromus tectorum**), and there are also scattered clumps of sagebrush (**Artemisia**) and rabbitbrush (**Chrysothamnus**).

Pence-Duerig Cave is located in a small alcove along the base of the northeast rim of the Devils Corral, at the base of a basalt cliff about 70 feet below the top of the canyon. The cave was evidently formed by a rockfall along a horizontal joint in the basalt (Fig. 1, B). Its dimensions are 57 feet wide at the opening, 46 feet deep,and 9 feet high.

B. History of archaeological work at the cave.

Pence-Duerig Cave was reportedly first discovered by a man named Johnson from Rupert, Idaho, in 1909. He later showed the site to Robert Pence and Jack Duerig of Twin Falls, Idaho, who made a surface collection but left the site otherwise undisturbed. In 1937 Mr. Pence reported the site to Dr. Charlton G. Laird, director of the historical museum at the Southern Branch of the University of Idaho (now Idaho State College), Pocatello. In May 1937 Dr. Laird, accompanied by Mr. Pence and several students and members of the faculty from the college, undertook excavations at the site.

Unfortunately available records of the excavations are very sketchy. Care was reportedly taken in the field to segregate materials from various levels and various areas within the cave, with placement into labeled sacks and envelopes; but this data on provenience was evidently not recorded before the artifacts were placed on temporary exhibit in the Old Student Union Building of the college. Worse still, some of the artifacts, cordage and hide, were placed in an exhibit case on "the cave-dwellers of Idaho" evidently with material from another cave near Howe, Idaho, far to the northeast; and thus certain parts of the two collections may now be mixed.

In 1954-1955, when the Idaho State College Museum was moved to its present location in the basement of the college library building, the artifacts in the exhibit cases were recataloged by Dr. Sven Liljeblad, a professional anthropologist who put on file extremely thorough and detailed descriptions of the individual artifacts. In 1959-1960 the material was examined and classified by the writer in the course of her stay at the Idaho State College Museum while analyzing material from the site of Wilson Butte Cave in the northeast part of Jerome County, about 20 miles northeast of the Devils Corral (Gruhn 1961).

C. Records of the excavations

The field notes of the college party in 1937 and a brief summary of the site now on file at the Idaho State College Museum do provide some information on conditions encountered in the excavations. The excavators found a number of large rocks protruding from the fill, dividing the cave into three irregular rooms; and trenches were put through the north, central, and south rooms. The fill in the cave was evidently composed of four stratigraphic layers.

Layer 1, extending 2 to 5 inches in depth from the surface, was a thin layer of drift sand and loess, containing dung from domesticated goats. There was also some burned bone, bark shreds, berries, flint chips, and a few artifacts probably derived from the underlying layer.

Layer 2, 2 to 8 inches in thickness, was a dry deposit composed of shredded bark, "reeds and

rushes", ashes, numerous small flint chips, and broken and charred bones. The most numerous bones were those of some large mammal presumed to be bison, but there were also smaller bones probably of deer or antelope, and also bones of rodents. Mussel shells, fish vertebrae, crayfish shells, grass seeds, and juniper berries suggest other items in the diet of the prehistoric people. A number of hearths were evidently found on this level in all parts of the cave. The shredded bark and grass were thickly matted in places, and this material probably served as bedding. Numerous artifacts were evidently found in this layer, and some described in field notes are identifiable in the Museum collection. Dry "debris" found at the front of the cave, in some areas buried under large rocks fallen from the roof, was believed to be related to this Layer 2.

Layer 3, from 6 to 18 inches in thickness, consisted of reddish loess and rust-colored droppings of some unidentified animal. Available photographs suggest an integrading with Layer 2. Layer 3 reportedly yielded much evidence of fires in the form of charcoal and ashes. The report states that no artifacts other than one small projectile point which possibly dropped into the trench from a higher level were found; however, Dr. Laird has informed me (personal communication, Autumn 1960) that artifacts did occur below Layer 2.

Available photographs show a marked disconformity between Layer 3 and Layer 4. Layer 4, up to 3½ feet in thickness, was reportedly composed of windblown (?) sand and droppings of the same unidentified animal as in Layer 3. These droppings became less numerous toward the bottom of the deposit. Apparently no evidence of human habitation was found in Layer 4. It was not stated explicitly whether this layer directly overlay bedrock.

On the basis of these data, it would seem that most of the artifacts in the Museum collection came either from Layer 2 or the related "debris" near the front of the cave. The provenience of some of the more distinctive artifacts has been given in the summary, and these will be cited as the artifacts are described below.

II. STONE ARTIFACTS

A. Chipped Stone Artifacts

1. Points

A total of 53 classifiable points are included in the collection from Pence-Duerig Cave. These have been divided into 11 types primarily on the basis of distinctions in form of base and blade. Thirteen additional point fragments are not included in the classification.

Type 1 (Fig. 2, A)
Number of specimens: 5, 9.4% of total collection.
Form: Nonstemmed; broad triangular or leaf-shaped blade, excurvate sides, straight or convex base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size Range: Length 2.8-4.8 cm., width 1.9-2.4 cm., thickness 0.4-0.5 cm.
Materials: 3 Chalcedony, 1 quartz, 1 ignimbrite.
Comparable types:
Idaho point type 4: Swanson, Tuohy, and Bryan 1959:6.
Comment: This form may have been used as a knife.

Type 2 (Fig. 2, B,C)
Number of specimens: 2, 3.8% of total collection.
Form: Both specimens basal fragments. Broad leaf-shaped blade with excurvate sides. One specimen has a very slight basal constriction beginning at a point 1.1 cm. up the blade from the base. Base concave. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking. Basal thinning.
Size Range: Length over 3.3 cm., width 2.3 cm., thickness 0.6 cm.
Material: 2 ignimbrite.
Comparable types:
Idaho point type 17: Swanson Tuohy, and Bryan 1959: 10.
Danger Cave type W 8: Jennings 1957: 108.
Comment: To judge from the time range of comparable types, this form appears to be an earlier point type than the rest of the collection.

Type 3 (Fig. 2. D)
Number of specimens: 2, 3.8% of total collection.
Form: Nonstemmed; leaf-shaped blade with excurvate sides, straight base. Plano-convex or lenticular cross-section.
Technique: Crudely shaped by moderately well-controlled pressure flaking.
Size Range: Length 2.9-3.0 cm., width 1.3-1.7 cm., thickness 0.5-0.6 cm.
Comparable types: None known.
Comment: Very crude specimens, possibly aberrant.

Type 4 (Fig. 2, E)
Number of specimens: 1, 1.9% of total collection.
Form: Nonstemmed; equilateral triangular outline, straight sides, straight base. Lenticular cross-section.
Technique: Well-controlled bifacial pressure flaking.
Size: Length 1.9 cm., width 1.9 cm., thickness 0.4 cm.
Material: Chalcedony.
Comparable types:
Idaho point type 1: Swanson, Tuohy, and Bryan 1959: 6.

Type 5 (Fig. 2, F)
Number of specimens: 1, 1.9% of total collection.
Form: One basal fragment only. Nonstemmed; long narrow triangular blade with incurvate sides, concave base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size: Length 2.1+ cm., width 1.7 cm., thickness 0.3 cm.
Material: Ignimbrite.
Comparable types:
Idaho point type 3: Swanson, Tuohy, and Bryan 1959:6.

Type 6 (Fig. 2, G)
Number of specimens: 1, 1.9% of total collection.
Form: Single specimen is only a medial fragment. Long narrow triangular blade, wide contracting stem. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size: Length over 4.0 cm., width 2.1 cm., thickness 0.6 cm.
Comparable types: None known.
Comment: Form could have been used as a knife or a piercing tool.

Type 7 (Fig. 2, H)
Number of specimens: 1, 1.9% of total collection.

Form: Nonstemmed; long narrow triangular outline with excurvate sides and straight base. Triangular cross-section.
Technique: Made on slightly curving flake by well-controlled collateral pressure flaking forming slight median ridge on dorsal surface. Ventral surface retouched only along edges, point, and base. Basal thinning.
Size: Length 4.6 cm., width 1.5 cm., thickness 0.5 cm.
Material: Ignimbrite.
Comparable types:
Wilson Butte Cave point type 6a: Gruhn 1961: Plate 13, P-Q.

Type 8 (Fig. 2, I)
Number of specimens: 1, 1.9% of total collection.
Form: Thick; long narrow triangular blade with straight sides; corner removed to produce sloping shoulders, long broad straight stem with convex base. Lenticular cross-section.
Technique: Rather roughly chipped by percussion flaking.
Size: Length 4.2 cm., width 1.9 cm., thickness 0.8 cm.
Comparable types:
Idaho point type 46: Swanson, Touhy, and Bryan 1959: 17.
Danger Cave type W 14: Jennings 1957: 112.
Deadman Cave type VII: Smith 1952: Fig. 5, D, 5.
Comment: This form, like Type 2, appears to be an earlier point type than the rest of the collection.

Type 9 (Fig. 2, K)
Number of specimens: 5, 9.4% of total collection.
Form: Broad triangular blade; straight or excurvate sides; deep corner notches producing wide barbs, in some cases asymmetrical; expanding stem; straight base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size Range: Length 2.6-2.9 cm., width 1.8-2.3 cm., thickness 0.3-0.6 cm.
Materials: 4 ignimbrite, 1 obsidian.
Comparable types:
Idaho point types 62 or 91: Swanson, Touhy, and Bryan 1959: 21, 29.
Wilson Butte Cave point type 11d: Gruhn 1961: Plate 14, T.
Deadman Cave type I: Smith 1952: Fig. 4, A.

Type 10a (Fig. 2, J)
Number of specimens: 1, 1.9% of total collection.
Form: Long narrow flaring triangular blade with slightly incurvate sides, deep broad basal notches inward directed, long rounded barbs, straight narrow stem with straight base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size: Length 3.1 cm., width 2.2 cm., thickness 0.4 cm.
Material: Chalcedony.
Comparable types:
Idaho point type 93: Swanson, Touhy, and Bryan 1959: 29.
Wilson Butte Cave point type 12a: Gruhn 1961: Plate 14, U.
Danger Cave type W 38: Jennings 1957: 129.

Type 10b (Fig. 2, L-M)
Number of specimens: 5, 9.4% of total collection.
Form: Small; equilateral triangular blade with straight sides, deep corner notches, narrow barbs, expanding stem with straight or convex base. Lenticular cross-section.
Technique: Moderately well controlled bifacial pressure flaking.
Material: 3 ignimbrite, 1 chalcedony, 1 obsidian.
Comparable types:
Idaho point type 52: Swanson, Touhy, and Bryan 1959: 18.
Wilson Butte Cave point type 12b: Gruhn 1961: Plate 14, W.
Danger Cave type W 37: Jennings 1957: 129.

Type 10c (Fig. 2, N-P)
Number of specimens: 17, 32% of total collection.
Form: Small; narrow triangular blade, straight or excurvate sides, broad corner notches producing small short barbs, expanding stem, straight or convex base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size Range: Length 2.3-3.4 cm., width 1.1-1.6 cm., thickness 0.3-0.5 cm.
Material: 11 ignimbrite, 3 obsidian, 2 chalcedony, 1 quartz.
Comparable types:
Idaho point types 55, 91: Swanson, Touhy, and Bryan 1959: 19, 29.
Wilson Butte Cave point type 12c: Gruhn 1961: Plate 14, X-Y.
Danger Cave type W 37: Jennings 1957: 129.
Promontory Cave no. 1: Steward 1937: Fig. 4, a.
Deadman Cave type II: Smith 1952: Fig. 4, B-1, 5, 6.

Type 11 (Fig. 2, Q-S)
Number of specimens: 11, 21% of total collection.
Form: Small; triangular blade with straight or excurvate sides, broad shallow side notches, short stem with square or pointed spurs, straight or concave base. Lenticular cross-section.
Technique: Moderately well-controlled bifacial pressure flaking.
Size Range: Length 1.7-3.4 cm., width 1.1-1.6 cm., thickness 0.2-0.4 cm.
Materials: 8 ignimbrite, 2 obsidian, 1 chalcedony.
Comparable types:
Idaho point types 77, 84: Swanson, Tuohy, and Bryan 1959: 25, 27; Site 10 AA 15: Tuohy and Swanson 1960: Fig. 1, 84.
Wilson Butte Cave point type 10a: Gruhn 1961: Plate 14, M-N.
Promontory Caves: Steward 1937: Fig. 4, c.
Western Utah point type I B 1: Rudy 1953: Fig. 32, b.
Roaring Springs Cave: Cressman, Williams, and Krieger 1940: Fig. 10, specimen 1-3517.
Desert Side-notched points (General): Baumhoff and Byrne 1959: Pl. 1, a, c.
Comment: One specimen retains sinew binding across stem and through side notches.

2. Knife Blades

The collection from Pence-Duerig Cave included two lanceolate chipped stone points which probably served as knife blades. The best-made specimen is a long leaf-shaped blade 7.8 cm. in length, 2.6 cm. in maximum width, and 0.7 cm. in maximum thickness, with straight sides and rounded base. It was made on a slightly curving flake with a plano-convex cross-section. Moderately well-controlled percussion or pressure flaking extended over the dorsal surface, but the ventral surface was retouched only along the edges. This specimen is made of a brown chert.

The other specimen is a biface implement with a thick, irregular oblong outline. Its length is 5.5 cm., width 2.5 cm., and maximum thickness 1.1 cm. At the narrow end a transverse edge 1.6 cm. long is very steeply retouched bifacially. This object was made by poorly controlled bifacial percussion flaking. It is of white chalcedony with a crazed surface.

3. Drills and Perforators

The collection from Pence-Duerig Cave included 6 pointed chipped stone tools. Four of these specimens have long thick retouched points; and appear to be drills; the other two specimens have smaller points and appear to have been used as perforators or gravers.

One drill point is a large specimen with a narrow bifacially retouched point broken 0.5 cm. from the base (Fig. 3, A). The base of this specimen is large and diamond-shaped in outline, broken on one side; and it is steeply retouched along the edges of the dorsal surface by moderately well-controlled percussion flaking. Its dimensions are: length 5.4 cm., maximum width 3.5 cm., and maximum thickness 1.0 cm. The base of the drill point is 0.7 cm. in diameter. This specimen is made of yellow chalcedony.

Two other drill points have long narrow triangular points steeply retouched bifacially. The outline of these two specimens is pentagonal, with broad contracting stem and straight base. They are lenticular in cross-section. One specimen is 5.0 cm. long; 2.6 cm wide, and 0.8 cm. thick (Fig. 3, B); the other 5.6 cm. long, 2.8 cm. wide, and 0.8 cm. thick. Both of these specimens are made of white chalcedony. A comparable specimen was evidently found in Promontory Cave no. 1 (Steward 1937: Fig. 30, d), and there is also a comparable example in Assemblage V at Wilson Butte Cave (Gruhn 1961: Plate 17, A).

Another specimen is similar but has a more rounded teardrop-shaped outline with a narrow, blunt, steeply retouched point projecting 1.3 cm. from a round base. This specimen has a plano-convex cross-section, with pressure flaking steeper on the dorsal surface than on the ventral surface. This specimen is 3.8 cm. long, 2.3 cm. wide, and 0.5 cm. thick. It is made of dark chalcedony. A comparable form apparently was found in Promontory Cave no. 1 (Steward 1937: Fig. 30, f).

Another perforator is hafted in a handle of willow wood (Fig. 3, C). It has a chalcedony point with a broad base and small elongated retouched tip now broken. The sides of the stone blade have been beveled and the base is straight. The total length of the stone point is 3.3 cm., its maximum width 3.4 cm., and its maximum thickness 0.7 cm. The stone point is hafted in a longitudinal notch cutting 3.0-3.2 cm. deep into the thick wooden handle; and is held with some sort of glue, possibly coniferous pitch. The wooden handle is 11.6 cm. long, 2.4 cm. in maximum width, and 1.9 cm. in maximum thickness. Both ends of the handle have been cut blunt, and the sides are smoothed and convex. Total length of this implement is 12.5 cm.

Another chipped stone perforator or graver is a small irregular-shaped flake with steep pressure retouch around the edges of the dorsal surface, and a small sharp retouched point at one corner. There is flat retouch on the ventral surface of the end opposite the point. Traces of black pitch extending within 1 cm. of the point indicate former hafting. The length of the specimen is 4.2 cm., the maximum width 2.1 cm., and maximum thickness 0.6 cm. It is made of brown chalcedony.

4. Scrapers.

A total of 7 scrapers are included in the collection from Pence-Duerig Cave. Three can be classified as endscrapers, one as a thumbscraper, two as small thick keeled scrapers, and one as a crude scraper.

The three endscrapers are all uniface, made on thick curving flakes by steep pressure retouch on the dorsal surface around a convex bit (Fig. 3, D). All are broken. One specimen also has retouched sides, one side worked along the edge of the ventral surface. All specimens are made of chalcedony. They range in length from 2.1 to 3.3 cm., in maximum width from 2.6 to 3.1 cm., and in maximum thickness from 0.6 to 0.9 cm.

The thumbscraper is small, circular in outline, and uniface with steep retouch by well-controlled pressure flaking all around the edges of the dorsal surface. Its diameter is 2.5 cm. and maximum thickness 0.5 cm. This specimen is made of opal.

The 2 small uniface keeled scrapers are made on thick flakes by moderately well-controlled percussion flaking of the dorsal surface. Both are roughly oval in outline, with convex bits. One specimen has some retouch at bit and butt on the ventral surface. The size range is: length 2.7-3.1 cm., maximum width 2.2 cm., and maximum thickness 0.8-1.0 cm. One specimen is made of chalcedony, the other black ignimbrite.

The crude scraper is oval-shaped, and made on a thick flake by poorly controlled bifacial percussion flaking. Its length is 4.9 cm., maximum width 3.8 cm., and minimum thickness 1.7 cm. It is made of white chalcedony.

5. Small Thick Bifaces.

This category is a group of 5 small, thick, bifacially worked stone artifacts which may have been used as small knives or scrapers (Fig. 3, F-G). All were made by moderately well-controlled bifacial percussion flaking. They are oval or triangular in outline, with thin rounded base and thick irregular cross-section. The size range is: length 2.1+-3.3 cm., maximum width 1.9-2.3 cm., and maximum thickness 0.7-1.0 cm. Three of these specimens are made of chalcedony, two of black ignimbrite.

6. Miscellaneous chipped stone artifacts

One unique chipped stone artifact included in the collection from Pence-Duerig Cave is a crescent-shaped object with one "horn" broken (Fig. 3, E). The dorsal surface is worked by mod-

erately well-controlled pressure flaking, the ventral surface retouched only along the outside edge of the crescent. The length of this specimen is 3.3 cm., maximum width 1.6 cm., and maximum thickness 0.6 cm. It is made of white chalcedony. The distribution of this type of artifact has recently been summarized by Riddell (1960: 30-31).

Another unique specimen is a uniface pointed blade with retouch by pressure flaking only on the dorsal surface. The edges are steeply retouched. The specimen is triangular in outline, but the base is broken, and there is a suggestion of a contracting stem. The length of this specimen is 3.9 cm., maximum width 2.7 cm., and maximum thickness 0.7 cm. It is made of olive-green chalcedony.

The collection from Pence-Duerig Cave included one small tabular piece of calcite. Small irregular flakes have been removed from the sides, and there is evidence of battering along one edge. The piece has a rectangular cross-section. Its length is 4.0 cm., maximum width 2.1 cm., and maximum thickness 1.3 cm.

Also in the collection were 4 small utilized or retouched flakes of black ignimbrite. These specimens are retouched or show signs of use along one edge of the dorsal surface. One is a core-trimming flake.

B. Ground Stone Artifacts

1. Grinding or pounding implements

a. Mortars

The collection of artifacts from Pence-Duerig Cave included 5 complete stone slab mortars and 2 fragments of stone slab mortars. All consisted of small, round, shallow cavities pecked into a flat surface on a slab or block of basalt.

One of the complete mortars is made on an oblong block of basalt with dimensions 31 x 19 x 11 cm. An oval-shaped cavity 14 cm. long, 11 cm. wide, and 1.3 cm. in maximum depth has been pecked into a flat surface. This specimen has lichen growth on the base, and was evidently exposed on the surface of the site. Another complete mortar is made on a vary irregular block of basalt with maximum dimensions 25 x 23 x 9 cm. It has a very shallow concavity 0.5 cm. in maximum depth covering an area of 17 x 13 cm. on a flat surface. Smudges of red hematite paint adher to one side of the stone.

The other 3 complete mortars consist of thick irregular slabs of basalt with shallow round concavities pecked into a flat surface. The concavities range in maximum diameter from 16 to 14 cm., and the maximum depths of the concavities range from 1.0 to 0.5 cm.

Several other fragments of slab stone mortars retain part of the small shallow pecked concavity. One specimen is a flat slab of basalt with maximum dimensions 21 x 12 x 9 cm., with a pecked concavity 11 cm. in estimated diameter and 1.5 cm. in maximum depth on one flat surface. Another fragment of a mortar, a flat slab of basalt with maximum dimensions 15 x 13 x 7 cm., has about one quarter of a circular concavity 1.0 cm. in maximum depth pecked into one flat surface.

b. Milling Stones

Only 2 flat grinding stones were included in the collection of artifacts from Pence-Duerig Cave. One is a tabular slab of vesicular basalt with maximum dimensions 40 x 32 x 6 cm. One flat side has a smoothed area approximately 30 x 20 cm. Some small smudges of red hematite paint adhere to this surface. The other specimen is an irregular block of basalt with maximum dimensions 25 x 22 x 9 cm., bearing on one flat surface a smoothed, slightly concave area approximately 15 x 10 cm. containing stains of red hematite paint.

c. Pestles

There are 12 pestles or fragments of pestles. Only 2 specimens were complete, and most of the fragments were small and nondescript. The pestles are of basalt or quartzite, generally natural pebbles with little intentional shaping. Some show evidence of use on the sides as well as the ends.

The largest complete specimen is a natural oblong cobble of quartzite, tapering toward the upper end. It is about 21 cm. long and 8.4 cm. in maximum diamenter. The widest end, oval in section, has a small battered area. Large smudges of red hematite paint extend up one flat side. The other complete specimen is a natural rounded cobble of basalt 14.4 cm. in length and 8.9 cm. in maximum diameter. The larger end, round in section with surface diagonal to the long axis of the cobble, shows evidence of pounding or grinding. Another specimen is a split fragment of a cylindrical quartzite pestle well-shaped by pecking. It is 14.0 cm. long and 6.9 cm. maximum diameter, tapering toward the butt, and was probably oval in cross-section.

Three fragments are apparently end-pieces of cylindrical pestles. One specimen 8.4+ cm. long and 5.6 cm. in maximum diameter, is of basalt; and was evidently shaped by pecking. Its end is small and round in section, and shows evidence of pounding. Another specimen is about 11.7+ cm. long and 6.5 cm. in maximum diameter. The blunt end, oval in section, shows evidence of pounding. Small smudges of red hematite paint adhere to the sides and end of the pestle. Another end-piece of a pestle is a quartzite pebble with a large battered area on the blunt end. It is 4.3+ cm. long, 5.5 cm. in maximum width, and 4.6 cm. in maximum thickness.

The remaining 6 fragments of pestles, 5 quartzite and 1 basalt, are too small to merit description. Three of the quartzite specimens show evidence of shaping by pecking. One midsection of a cylindrical pestle has been worn flat on two opposing sides.

C. Manos

Four fragments of manos were included in the collection of artifacts from Pence-Duerig Cave. All are made of natural cobbles or tabular pieces of basalt.

The largest fragment is about half of a mano made on a loaf-shaped basalt cobble. It is 8.0+ cm. long, 9.4 cm. wide., and 5.8 cm. in maximum thickness. One surface is flat and smooth from rubbing. Another smaller fragment of a cobble mano, 5.3+ cm. long and 6.8 cm. wide, is made of fine-grained basalt. One surface has been worn smooth by rubbing.

One specimen is made on a tabular slab of glassy basalt. It is fractured at both ends, but is 9.1 cm. wide and 3.0 cm. in thickness. It is completely flat on both sides, one side worn smoother than the other. The less smooth side bears an extensive area of red hematite paint. Another smaller fragment of a mano made on a tabular slab of glassy basalt is 3.2 cm. in thickness. It has a flat smooth grinding or rubbing surface only on one side.

2. Shaftsmoothers

There are two fragments of grooved shaftsmoothers made of tuff or scoriaceous basalt. They were probably rectangular in outline, with rounded corners and flat upper and lower surfaces. The smaller specimen, 4.6+ cm. long, 2.4+ cm. wide and 1.6 cm. in maximum thickness, has straight vertical sides and rounded end; the other specimen, 5.0 cm. long, 5.6 cm. wide, and 1.7 cm. in maximum thickness, has convex sides with rounded edges. On the first specimen the groove is 0.2 cm. deep and 0.6 cm. wide, and runs longitudinally straight across a flat surface. On the second specimen the groove is 0.3 cm. deep and 0.9 cm. wide, and runs longitudinally across a flat surface at a slight angle. In the field notes there is mention of an arrow smoother being found in the "debris" at the front of the cave.

3. Tubular stone pipes

The collection from Pence-Duerig Cave included a fragment of a large tubular pipe of tuff. Both ends of the specimen were broken off, and the length of the fragment is only 3.7 cm. Concentric marks within the bore indicate conical drilling from the large end toward the small. There is no evidence of charring within the bore. The walls vary in thickness from 0.5 cm. to 1.0 cm., the bore being placed off center. The diameter of the large opening is 1.6+ cm., the diameter of the small opening 1.0 cm. The exterior surface of the pipe is smooth.

Another fragmentary specimen may be an incomplete tubular pipe. It is very thick-walled, with a smooth convex exterior surface. The interior shows concentric marks left by drilling, again off center. The length of this fragment is 5.5 cm. and its estimated maximum diameter is 2.5 cm. It is made of a dark-colored soft scoria or tuff, and appears to have been exposed to fire.

A small fragmentary drilled object made of tuff is possibly the mouthpiece of a tubular pipe. It has been drilled from each end biconically, with the fracture at the narrow place where the drill holes met. The exterior surface of the object is smooth and convex, tapering to the smaller end. The diameter of the small drilled opening is 0.45 cm., the larger drilled opening 1.0 cm. The total length of the fragment is 1.1 cm. and its maximum diameter 1.6 cm.

4. Grooved stone

This artifact is a small cigar-shaped object of scoriaceous basalt with tapering ends, one end blunt and the other notched and grooved longitudinally. The groove was evidently made diagonally from opposite sides, producing a V-shaped notch 0.9 cm. in depth, with the groove marks extending 0.9 cm. further down the stone on either side. The width of the grooves on either side is 0.3 cm. The bottom of the groove shows fine striation marks. The total length of the object is 4.5 cm. and its maximum diameter 1.7 cm. The use of this object is uncertain - it may have been an abrading implement for preparing sinew cord.

A similarly-shaped stone, oval in outline with tapered ends and sides ground smooth but not grooved, may be such an object in the process of manufacture. It is of a dark-colored soft scoria or siltstone, and appears to have been exposed to fire. Its length is 5.3 cm. and maximum diameter 2.5 cm.

5. Pieces of hematite clay

The collection of artifacts from Pence-Duerig Cave includes a number of pieces of red hematite clay presumably used for paint. Eighteen specimens are of irregular size and form, but 4 pieces have evidently been shaped.

Two of these 4 shaped pieces are large conical pieces with sides smoothly convex and ends flat. The length of the largest and most complete specimen is 7.9 cm., and its maximum diameter 3.8 cm.; the other specimen, broken, is 6.6 cm. long with a maximum diameter of 3.2 cm. Another similar conical-shaped piece of red hematite clay is much smaller (length 3.3 cm. and maximum diameter 2.2 cm.); and has a hole about 0.3 cm. in diameter and 0.2 cm. in depth drilled longitudinally into the large end, presumably to obtain powder for paint. The last shaped piece is almost square in shape, with two opposing sides flattened and the other two sides convex. A hole 1.2 cm. in maximum diameter and 1.7 cm. in depth has been drilled longitudinally into one end. Each side of the object also has one drilled hole, averaging 0.3 cm. in diameter and 0.2 cm. in depth, irregularly placed. In addition, a groove 2.0 cm. long and 0.1 cm. wide runs diagonally across the end opposite the largest drilled hole.

The drilling was probably to obtain powder for paint.

6. Miscellaneous ground stone artifacts

A unique chisel-shaped object is an elongated segment of consolidated volcanic ash roughly oval in cross-section, with two flattened surfaces coming to chisel-like point at one end. Faint diagonal grinding scars cover the sides. The length of the specimen is 6.0 cm, width 2.2 cm., and maximum thickness 1.9 cm.

Also included in the collection was a fragment of a small oval-shaped stone with flat upper and lower surfaces and rounded edges. It is made of a reddish-colored soft scoria. Its length is 3.6+ cm., width 3.5+ cm., and maximum thickness 1.0 cm.

D. Miscellaneous Stone Artifacts

1. Handled stone blade wrapped with sagebrush bark strands.

This unique stone artifact is composed of three thin rough slabs of basalt, two long pieces placed adjacent to each other to form a sort of handle, and the base of the third piece, which is shorter and broader, inserted between the first two slabs to form a blade, the whole being bound together by a wrapping of flat sagebrush bark strands (Fig. 3, H). The object has a total length of 17.0 cm. The length of one handle-piece is 10.5 cm. and its maximum width 3.4 cm.; the length of the other handle piece is 11.1 cm. and its maximum width is 3.0 cm. Total thickness of the handle is about 2.2 cm. The blade or slab of stone inserted between the two handle pieces has a total length of 10.5 cm., of which 5.0 cm. is enclosed in the handle; the maximum width of this blade is 5.6 cm. The sides of the blade constrict toward the bit, which is square in outline but has a concave edge. The total thickness of the blade is about 0.5 cm. This object could be a crude knife, chisel, or scraper.

2. Piece of white paint material

This specimen is a small flat tabular fragment of white diatomaceous earth with irregular outline. One flat surface has a series of fine parallel grooves or scratches up to 3 cm. in length covering an area 1.5 cm. wide. The total length of the specimen is 3.9 cm., width 3.0 cm., and thickness 0.9 cm. It may have been used for white paint.

III. BONE ARTIFACTS

A. Bone Awls

The collection of artifacts from Pence-Duerig Cave included 5 bone awls, but only one specimen is complete (Fig. 4, H). This is a splinter awl, made on a wide flat splinter evidently from the leg bone or rib of a large mammal. The tip has rounded edges and is polished further up one side than the other, and the base of the awl is also rounded and polished. The length of this specimen is 8.0 cm, its maximum width 1.7 cm., and its thickness 0.2 to 0.3 cm.

The other four specimens are only broken tips (Fig. 4, G). Three were evidently made on splinters of flat rib bone, with marrow still adhering to the under surface. On all specimens the tip has rounded sides and is polished, the polish extending far up the edges of the shaft. Each of these three specimens has a series of fine, short, very closely spaced transverse or longitudinal scratches on the shaft of the point, evidently a result of grinding. The lengths of these fragments range from 2.4 to 4.4 cm., widths 1.0 to 1.1 cm., and thicknesses 0.4 to 0.6 cm. Two specimens are charred.

The last fragment of a bone awl is evidently made from a segment of a narrow long bone of a large mammal (Fig. 4, F). The butt end is broken off at a distance of 3.7 to 5.7 cm. from the point. The edges of the point have been ground smooth, and traces of diagonal cut scars extend down the shaft on two sides from the point for a distance of 3.1 cm. Maximum width of the fragment, at beginning of the fracture, is 0.9 cm.

B. Bone Dice (Fig. 4 ,L-P)

A total of 5 bone dice, small rectangular-shaped pieces of bone, were included in the collection from Pence-Duerig Cave. They are all evidently made from flat rib bones cut into segments by transverse grooves. The marrow still adheres to the under surface, which is beveled at each end, slanting underneath. The upper surface is smooth and undecorated. The edges of each piece are polished, and corners rounded. On one specimen the sides are slightly convex; on the others the sides are straight. The size range is: length 2.1 to 2.3 cm., width 1.3 to 1.6 cm., and thickness 0.5 to 0.6 cm. Two of these pieces are reported in the field notes as being found in Layer 2 of the cave deposits. They are almost identical to specimens which occur in the Dietrich phase assemblage at Wilson Butte Cave (Gruhn 1961: Plate 21: H-J).

C. Incised Bone Shaft (Fig. 4, A-C)

This unique specimen is a long, smooth, flat, polished bone shaft probably made from a split rib. It is now broken into at least three pieces, with intervening sections missing.

The first segment, an end piece 8.2 x 1.8 x 0.6 cm. in dimensions, widens from the shaft and then tapers to a smooth blunt point (Fig. 4, A). The cross-section is plano-convex, with some traces of marrow present on the flat side. Both the upper and lower surfaces are covered with fine, shallow, irregular longitudinal or diagonal scratch marks evidently resulting from the grinding process. At the broken end of this segment is a set of two finely incised ladder-like designs, parallel to each other at a distance about 0.3 cm. apart and running longitudinally from the broken

edge a distance of 1.5 cm. down the shaft toward the point. The ladders are each 0.35 cm. wide, and have a series of 8 finely incised transverse lines or "rungs" spaced at intervals of 0.2 to 0.3 cm. At a distance about 2.3 cm. from the end of this piece is a fainter incised "ladder" design, with four "rungs" spaced at intervals of about 0.5 cm., between two longitudinal lines 0.5 cm. apart.

The second fragment, 5.3 x 1.6 x 0.6 cm. in dimensions, is a segment of the shaft of the object, polished smooth; and is plano-convex in cross-section, with traces of marrow on the flat side (Fig. 4, B). The surface is covered with fine shallow longitudinal grooves, evidently marks of heavy grinding. A series of fine incisions 0.3 to 0.9 cm. long run transversely across the shaft at intervals of 0.2 to 0.4 cm., with the longest and more closely spaced incisions at the end nearest the first segment of the object.

The third fragment of the object, 3.3 x 1.5 x 0.4 cm. in dimensions, is also a segment of the shaft, with a flatter cross-section and converging sides (Fig. 4, C). Fine longitudinal scratches run the length of the fragment, and traces of marrow adhere to the undersurface despite heavy grinding and polishing. A series of six fine transverse incisions 0.8 to 1.1 cm. in length run across the shaft at intervals of 0.3 to 0.5 cm. Both ends of this fragment are fractured, and the rest of the piece is lost.

D. Reel-shaped Bone Object (Fig. 4, D)

This artifact is a small, flat, short, curving hyoid bone of a bison with its sides and ends rounded, ground and polished. The narrower end has a gouged perforation 0.2 cm. in diameter in its center. A loose wrapping of fine sinew (diameter 0.05 cm.) begins at a point 2.5 cm. from the wider end of the bone and extends for a distance of 1.5 cm. up the shaft. The surfaces of the shaft bear many fine irregular longitudinal scratches evidently the result of grinding. The dimension of the object are: length 9.9 cm., maximum width 2.2 cm., and thickness 0.4. This object is undoubtedly one described in the field notes as coming from Layer 2 in the cave deposits. A somewhat similar object was apparently found in Gypsum Cave, Nevada (Harrington 1933: 155).

E. Blunt Bone Point (Fig. 4, I)

This object is a thick, blunt, conical-shaped, polished bone point fractured at one end. The tip is blunt, with a plano-convex cross-section. A series of small, short, shallow transverse scratches are observable on one side of the shaft. The object is at present 3.6 cm. long, 1.2 cm. wide, and 0.8 cm. in maximum thickness. It may have been the tip of a flaking tool.

F. Flat Bone Object (Fig. 4, J)

This specimen is a thin, flat, bluntly pointed bone piece broken at one end. Thin longitudinal cut scars run down the edges of the piece toward the point, and the sides and surfaces are polished. It is 2.2 cm. long (fractured at one end), 1.6 cm. wide, and 0.2 cm. thick. It may have been the end of a bone spatula.

G. Smooth Bone Shaft

This object is evidently a segment of the shaft of a large long bone of a mammal, broken at both ends and charred at the wide end. The exterior surface is smooth and shows some traces of fine, short, diagonal cut marks. The object is 8.8 cm. long, 2.5 cm wide, and 2.2 cm. in maximum thickness. Its use is unknown.

H. Drilled Rodent Incisor (Fig. 4, K)

This specimen is a large broken incisor of a rodent, with a drilled pit 0.2 cm. in diameter and 0.05 cm. in depth located on the flat surface of the medial side. The point of the tooth also shows a series of close fine scratches or cut marks running longitudinally on either side of the shaft. The specimen is 2.0 cm. long, 0.4 cm. wide, and 0.6 cm. thick. It appears to be part of a die (**cf.** beaver-teeth dice of Northwestern groups in Culin 1907: 155-158).

I. Notched Antler Shaft (Fig. 4, E)

This specimen is a large segment of antler, with one sharp edge evidently polished by use. The widest end, which is fractured, has three triangular notches 0.4 cm. in depth cut into the exterior surface, producing four triangular teeth. The narrower end has also been notched transversely to a depth of 0.2 cm. Near the fractured edge of the wider end is a shallow transverse groove 0.9 cm. long and 0.3 cm. wide, and some random fine short scratches or cut scars run transversely across the shaft. The specimen is 9.7 cm. long, 2.1 cm. wide, and 1.6 cm. in maximum thickness. It may have been a fleshing tool (**cf.** Lowie 1924: 227)

J. Antler prong

This specimen is the end of a deer antler prong about 10.5 cm. long, with one end fractured. The point shows signs of wear, and the object is probably a flaker.

IV. POTTERY

Several potsherds recovered from Pence-Duerig Cave after the 1937 excavations were given to the Idaho State College Museum by Mr. Larry Olsen of Jerome, Idaho.

Size of sample: 2 rim sherds.
Color: Surface color dark grey. Carbon cake on interior of one sherd. Core interior dark grey.
Lustre: Dull

Surface texture: Rough, with temper showing through.
Thickness: Ranges from 0.9 to 1.2 cm., thinning toward rim.
Hardness: 3 on Mohs scale.
Temper: Heavy amount of angular quartz sand particles ranging in size from 0.1 to 0.4 cm., producing coarse texture.
Shapes: Rim - direct (Fig. 5, J). 2. Lip - rounded. 3. Vessel form - no evidence.
Decoration: No evidence.
Other features: Largest sherd has drilled perforation 0.3 cm. in diameter located 2 cm. below lip.
Evidence of pottery-making techniques: 1. Method of construction - no evidence. 2. Surface treatment - faint striations on one sherd indicate wiping with grass while clay was still moist. 3. Firing - color indicates incomplete oxidation, and firing was probably uncontrolled.
Function: Carbon cake on interior of one sherd suggest use as cooking vessel.
Comparisons: The form of the rim and lip, the thickness of the vessel walls, and the coarse temper identify these sherds as a Shoshonean ware. Sherds of generally similar pottery are well represented in Idaho State College Museum collections from various parts of southern Idaho. The Pence-Duerig pottery is very similar to a group of sherds described from a site near Glenn's Ferry, Idaho (Tuohy 1956: 61-62). Similar coarse-tempered, thick-walled Shoshonean pottery has also been found in western Utah (Rudy 1953: 94-98).

V. WOODEN ARTIFACTS

A. Fragment of bow

One end fragment of a bow was included in the collection of artifacts from Pence-Duerig Cave. Its length is 27.8 cm., maximum width 2.8 cm., and maximum thickness 1.3 cm., It is made of birch wood, and has broad flat sides with rounded edges tapering to a blunt square end. There is a single diagonal notch 0.4 cm. wide and 0.4 cm. deep in one edge at a distance of 1.8 cm. from the end. The broad end of the fragment is badly charred.

B. Parts of Arrowshafts

1. Notched wooden shaft

The collection from Pence-Duerig Cave includes a single example of a notched wooden shaft possibly the distal end of a wooden arrowshaft. It is a long, straight, smooth shaft of coniferous wood with one end broken and the opposite end tapered. The total length is 16.1 cm. and the maximum diameter 0.6 cm. The tapered end has a longitudinal notch 0.1 cm. wide and 0.8 cm. deep. At the base of the notch is a close wrapping of fine sinew extending for a distance of 1.4 cm. up the shaft. This sinew binding may have been used to secure the stone point.

2. Smooth wooden shafts with sinew binding

These are 2 specimens of long smooth shafts of juniper wood wrapped with sinew. The two shafts have tapering ends. One specimen, 18.8 cm. long and 0.8 cm. in maximum diameter, has a loose binding of wide strips of sinew beginning at a point about 3.3 cm. from one end and extending for a distance of 1.7 cm. down the shaft. At a point 0.3 cm. further down the shaft begins a tight wrapping of fine sinew extending for a distance of 0.7 cm. further down the shaft. The other specimen, 29.5 cm. long with a maximum diameter of 0.8 cm., has a tight wrapping of fine sinew beginning at a distance of 4.0 from one end and extending for a distance of 0.9 cm. down the shaft. According to the field notes these two specimens were found in Layer 2 of the cave deposits.

3. Smooth wooden shafts

Thirteen specimens of smooth shafts of wood mostly juniper probably served as arrowshafts, possibly wooden foreshafts to be inserted into the cane mainshaft of a composite arrow. Manufacture evidently involved selection of a relatively straight branch of wood, peeling off bark, and smoothing the sides. Both ends of the shafts were tapered to blunt points. One incomplete specimen has one end of the shaft sharpened like a pencil from all sides, with the longitudinal cut scars extending for a distance of 3.8 cm. down the shaft from the point. There are also deep, jagged cut scars near the opposite end of this specimen, suggesting that the same procedure was intended. On several other specimens the edges of the cut points have been smoothed and rounded, with traces of fine diagonal cut scars left near the points. The length of complete specimens of these smooth wooden shafts ranges from 33.2 cm. to 23.7 cm., and the maximum diameters from 0.6 to 0.8 cm. The field notes mention a number of such smooth sticks found in the "debris" at the front of the cave.

4. Decorated fragment of wooden arrowshaft (Fig. 5, F)

This specimen is the broken end of a wooden arrowshaft with traces of feathering and painted decoration. The specimen is of cottonwood, and is 35.0 cm. long and 0.7 cm. in maximum diameter, with the butt tapered to a diameter of 0.4 cm. The butt of the shaft has a shallow V notch.

The shaft retains fragments of two split feathers, held in shallow longitudinal grooves in the shaft with glue and a very narrow sinew binding, painted with green and yellow, at each end. The length of the feathers was 15.5 cm. The feathered area is elaborately painted in green, yellow, black, and red. The design field is divided into five sectors by encircling bands. The central sector, 5.5 cm. long, is a solid green field with an undulating stripe of black and yellow paint 0.2 to 0.3 cm. wide extending its length on both sides. This central solid green sector is delimited at each end by a 0.3 cm. wide encircling band of yellow paint outlined with thin lines of black. In the center of each of these yellow bands is an encircling band of small black dots. Two more identical encircling bands are located at

points 2.0 or 2.1 cm. further along the shaft in each direction from this central sector, the intervening areas being undecorated. These bands are both 0.5 cm. wide, and each consists of two adjacent encircling stripes of yellow paint delimited by very thin black lines. In the center of each of these adjacent yellow stripes is a very thin encircling line of red paint. For a distance of 1.5 to 2.0 cm. on either side of these encircling lines the shaft is undecorated, and the design field as a whole terminates at the green and yellow painted sinew bindings holding the feathers in place.

5. Decorated wooden arrow points

The collection from Pence-Duerig Cave includes two broken wooden arrow points decorated with paint. They are evidently both of cottonwood. The largest is about 11 cm. long and 0.8 cm. in maximum diameter (Fig. 5, B). One end is tapered by whittling for a distance of about 1.8 cm. and ends in a sharp point, the other end is broken off. The piece is decorated in black paint by a spiraling set of two lines varying in width from 0.1 to 0.3 cm., with an interval of 0.5 to 0.8 cm. between successive spirals. The spiral runs up to the left from the point. This artifact is undoubtedly one described in the field notes as coming from Layer 2 of the cave deposits.

The second specimen is approximately 6.8 cm. long and 0.6 cm in maximum diameter (Fig. 5, A). One end is tapered for a distance of about 1.9 cm., the other end is broken off. The broken end is painted solid black for a distance of 1.2 cm. down the shaft and yellow for a distance of 0.3 cm. further toward the point. The remainder of the shaft is decorated with three encircling lines of red, black and yellow paint at intervals of 0.5 cm. The red stripe in these encircling lines is about 0.05 cm. wide, the black stripe 0.1 cm. wide, and the yellow stripe, now very faint, about 0.2 cm. wide. There also appear to be faint traces of black paint on the point.

6. Fragments of cane arrow mainshafts.

The collection of artifacts from Pence-Duerig Cave includes 6 fragments of cane (**Phragmites communis**) evidently parts of arrow mainshafts into which wooden foreshafts were inserted. Three specimens are evidently the distal or socket end and 3 specimens the proximal or nock end of the shaft.

The three fragments of distal ends of cane mainshafts have one cut end with edges evenly rounded, evidently the socket end. The fragments range in length from 22.5 to 3.9 cm., and in diameter from 0.9 to 1.2 cm. The shaft of the longest specimen is decorated with a spiral design evidently burned into the surface (Fig. 5, c). The design consists of three parallel lines about 0.2 cm. to 0.3 cm. apart spiraled in echelon up to the left around the shaft at intervals of 2.0 to 3.0 cm. The outer two lines are ticked on the outside at intervals of 0.2 cm. This decorated specimen is undoubtedly one mentioned in the field notes as coming from Layer 2 of the cave deposits.

The three fragments of proximal ends of cane arrow mainshafts range in length from 1.9 to 8.0 cm. and in maximum diameter from 0.8 to 1.1 cm. They have longitudinal U shaped notches 0.4 to 0.5 cm. cut at a joint in the cane (Fig. 5, D-E). Below the notch sinew wrapping extends for a distance of 0.4 to 1.0 cm. up the shaft, evidently as reinforcement. One specimen has traces of another such wrapping beginning about 1.0 cm. further down the shaft, perhaps to secure feathers.

Summary

Two basic types of arrows are represented in the collection of artifacts from Pence-Duerig Cave, single-piece and composite arrows. The single-piece arrows were evidently made of peeled shafts of juniper or cottonwood with ends tapered and notched. Sinew binding was probably used to hold the stone point. Only one example of the distal end of a single-piece arrow retained traces of feathering, two feathers held in shallow longitudinal grooves in the shaft by glue and also sinew binding at each end. On this specimen the feathered area of the shaft was painted in an elaborate design.

The composite arrows apparently consisted of a cane mainshaft and a wooden foreshaft with a tapered end which fit into the socket of the cane shaft. Evidently the wooden foreshaft was often the only point used in a composite arrow, and two specimens of wooden arrow points in the collection had painted decoration. Presumably a stone point was also often hafted in the wooden foreshaft of a composite arrow, but no examples were found. The cane mainshafts had U-shaped notches in the butt end, reinforced with sinew binding. One example of a cane mainshaft has pyrographic decoration in a spiral design.

C. Firedrill Shafts

Three specimens of wood may be firedrill shafts. One specimen is a short piece of wood probably of the family Caprifoliaceae, with very smooth sides, one end tapering evenly to a broken point, the opposite end also tapering but very thick and badly charred. This specimen, which is 8.1 cm. long and 0.8 cm. in maximum diameter, appears to be the foreshaft of a composite firedrill, fitting into a socket. The other two specimens are straight, smooth segments of unidentified wood with tapering ends which are charred. One specimen is 7.5 cm. long and the other 29.4 cm. long, and maximum diameters of both are 0.7 cm.

D. Wooden Hoops

There are five complete specimens and one fragment of hoops or bows of peeled willow wood. The largest specimen is almost circular, with only a gap of 9.5 cm. between the ends, but the other specimens are hemispherical. The maximum inside diameter of the hoops ranges from 45 cm. to 30 cm., and maximum radius of the hemispherical specimens ranges from 22.5 to 10 cm. The diameter of the wood ranges from 1.3 to 1.7 cm. On most specimens the ends are fractured or charred, but in two cases the ends of the wood have been cut blunt by short diagonal strokes from opposite sides. On one of these specimens a notch 1.2 cm. long, 1.0 cm. wide, and 0.2 cm. deep has been cut into the inside of the shaft at a point about 1.0 cm. up the shaft from the end. These hoops were possibly made by steaming the wood and bending it into shape while flexible.

These objects seem to be frames of some sort but their exact use is unknown. They could have been used to reinforce the rims of burden baskets (**cf.** Heizer and Krieger 1956, Pl. 12, g and h; Cosgrove 1947: Fig. 103, e), or they may have been rims for dip nets (**cf.** Steward 1943: 269), or rims for buckskin or salmon-skin bags (**Ibid.**: 302, 311). Dr. Liljeblad has also suggested that they might have formed the frame for a fish trap.

E. Twisted Pieces of Wood

The collection of artifacts from Pence-Duerig Cave includes eight twisted pieces of willow wood. Two specimens are large, with an estimated total length of 30 to 50 cm. and diameters of 1.0 cm. They are long, irregular branches of willow evidently stripped off the tree and twisted and coiled clockwise with such force that the wood has splintered. Several other smaller twigs have been incorporated in the twist. Another large specimen, with an estimated total length of 22 cm. and a diameter of 1.0 cm., is an irregular branch of willow violently twisted clockwise and looped into an overhand knot.

Four smaller specimens are short branches of willow which range in estimated total length from 7 to 22 cm. and in diameter from 0.6 to 1.0 cm. They are largely stripped of bark and twisted clockwise so that the wood has splintered. Another willow twig approximately 7.5 cm. long and 0.7 cm. in diameter, with reddish bark still adhering, is twisted and bent double upon itself; and several smaller twigs are included in the twist. Both ends of the larger twig are charred.

A number of similar specimens collected by Louis Shellbach from rockshelters in Ada and Owyhee counties, southwest Idaho, are on exhibit at the Idaho State Historical Museum in Boise. Similar objects were also apparently found in Lovelock Cave, Nevada (Lound and Harrington 1929: 94:95).

F. Miscellaneous Wooden Artifacts

1. Painted Wooden Shaft (Fig. 5, G)

This specimen of peeled willow is 21.0 cm. in length and 1.0 in diameter, with one end broken and the other diagonal and charred. A series of about seven encircling lines of black paint each about 0.5 to 0.2 cm. in width begin at a point 2.4 cm. above the charred point and extend for a total distance of 1.3 cm. up the shaft. About 8.3 cm. up the shaft from the point is another series of four encircling lines about 0.1 to 0.3 cm. in width covering an area of 1.0 cm. This object resembles an atlatl shaft.

2. Wooden Basketry Awl

This specimen is a very smoothly finished shaft of juniper 27.7 cm. long and 1.0 cm. in maximum diameter. One end of the rounded shaft tapers evenly to a conical point, which is slightly scorched; and the opposite end flattens and becomes constricted at a point about 0.3 cm. from the end, which is convex and ellipsoidal in cross-section. A line of very shallow transverse impressions 0.2 cm. wide and spaced at intervals of 0.15 cm. begins at a point about 12.5 cm. down the shaft from the pointed end. This line of marks, which seems to be decorative, extends for a distance of 4.3 cm. down the shaft, at which point a line of these marks diverges to the right at an angle of about 15° and continues for a distance of 1.5 cm., the first line continuing straight down the shaft a distance of 3.0 cm. from the point of divergence. The marks become darker in color toward the blunt end of the shaft.

3. Segment of sagebrush with sinew cordage attached

This specimen is an irregular twisted segment of sagebrush wood 24.5 cm. long and 1.2 cm. wide, cut square at one end and fractured at the other. A strand of sinew cordage 8.2 cm. long is tied in a clove hitch at a point about 1.8 cm. up the shaft from one end. The sinew cordage is 2 ply, a tight S twist, with a diameter of 0.1 cm.

4. Sagebrush-wrapped stick

This specimen is a twig of willow 12.7 cm. long and 1.2 cm. in maximum diameter. The bark has been peeled off, and in the approximate center of the shaft there is a very loose wrapping of thin flat strands of shredded sagebrush bark covering a total area of about 4.0 cm.

5. Small cut wooden piece

This specimen is a small tabular piece of birch wood 3.5 cm. long, 1.2 cm. wide, and 0.9 cm. thick, cut into a lozenge shape. One end is cut on two opposing sides to a point, with fine diagonal cut scars observable. The opposite end is similarly but very roughly cut, with frayed edges. There are traces of red paint decoration in lines 0.3 cm. wide along both edges of the upper

surface. The use of this object is unknown: it may be a wooden die.

6. Large pieces of cut wood

The collection of artifacts from Pence-Duerig Cave includes two large thick segments of juniper wood evidently cut. One cylindrical piece 27.7 cm. long and 4.2 cm. in maximum diameter, has one end cut diagonally 5 cm. but eroded, and the other end is splintered. Near the cut end there are very faint traces of red paint in an area 5.7 x 5.3 cm. The other specimen 17.5 cm. long and 4.4 cm. in maximum diameter, has one end cut diagonally from two sides to form a very rough point. The opposite end is charred diagonally. On a flat side of this specimen a shallow eroded groove 1.5 cm. wide runs transversely across the shaft at a point 6.3 cm. distant from the blunt end. These objects may be "two stakes" mentioned in the field notes as having been found in association with a fireplace at a depth of some 6 to 8 inches below the surface of the cave deposits.

7. Large piece of smoothed wood

This specimen is a large thick segment of unidentified wood, 15.0 cm. in length and 3.0 cm. in maximum diameter, with the bark removed. One end tapers to a very blunt point and the other end is badly charred. Very faint streaks of dark red paint are visible on the sides.

8. Plaited wooden object (Fig. 6, D)

This specimen is made from thin flat splints of split willow twigs, 0.3 to 0.4 cm. wide. The object has a "head", 3.0 cm. long and 2.4 cm. wide, of splints interwoven in a vertical staircase-like arrangement with the width decreasing toward the top. At both sides of the head each splint is bent at an acute angle and passes downward under the horizontal strip below to form the shaft or handle, which is wrapped at a point about 5.5 cm. below the top of the object with a short, flat, thin splint. The total length of the object is 18.0 cm. Its use is unknown.

VI. BASKETRY

The collection of artifacts from Pence-Duerig Cave includes a total of seven fragments of coiled basketry, all made of willow splints. Four of the fragments evidently came from the same basket, a vessel with a flat bottom. The type is close coil, one-rod foundation, with non-interlocking stitches occasionally split on one side. The average diameter of the coils is 0.5 cm., and there are 3 stitches per centimeter. The two larger fragments, about 18 cm. and 14 cm. long, respectively, contain one complete and one fragmentary coil each; the two small fragments, 3.5 and 2.5 cm. long, respectively, each contain one coil.

The coils of this basket were padded with thin layers of finely shredded sagebrush bark or an unidentified fine fiber probably **Apocynum.** This padding was evidently laid above and below the rod foundation before the sewing. Jennings (1957: 247) suggests that such fiber padding, when moist, swelled and made the basket watertight.

Of special interest is the occurrence on one of these small fragments of a small clump of tiny brown feathers (evidently down) laid adjacent to the one-rod foundation and evidently secured by the stitches, suggesting decoration of the basket by feather imbrication similar to that encountered on specimens of coiled basketry from Lovelock Cave (Loud and Harrington 1929: 65-68) and Humboldt Cave (Heizer and Krieger 1956: 51-52). Steward (1941: 241) mentions the occasional use of woven-in feathers in coiled basketry among some groups of Nevada Shoshoni, and credits the occurrence to influence from California.

Another specimen of close coil, one-rod foundation, with stitches split on one side, is a fragment 3.5 cm. long and 3.5 cm. wide, containing a total of ten coils (Fig. 5, K). The average diameter of the coils is 0.35 cm., and there are 4 stitches per centimeter. The foundation of this basket was not padded. The fragment appears to be tinted with red paint on the side where the split stitches occur.

Another specimen is a circular fragment with six coils, evidently the beginning work of an unfinished flat-bottomed coiled basket of close coil, one-rod foundation with the stitches split on one side (Fig. 5, L). The basket was evidently started with a small ring about 1 cm. in diameter. The coils are padded with fine fiber probably **Apocynum.** The average diameter of the coils is 0.3 cm., and there are 4 stitches per centimeter. The maximum diameter of the fragment is 5.5 cm.

The last fragment of coiled basketry, 7.5 cm. long and 1.5 cm. wide, includes only three coils, with close coil, two-rod vertically stacked foundation, non-interlocking stitch (Fig. 5, M). The average diameter of the coils is 0.5 cm., and there are 5 stitches per centimeter. The coils are not padded.

This collection of basketry fragments is too small a sample to draw valid conclusions, but it is interesting to note that two varieties of close coiled basketry are represented: one-rod foundation (3 examples) and two-rod foundation (1 example). Close coil, one-rod foundation basketry appears at archaeological sites in the Great Basin such as Danger Cave (Jennings 1957: 245), the Promontory Caves (Steward 1937: 34), Lovelock Cave (Loud and Harrington 1929: Pl. 29, e and f), Humbolt Cave (Heizer and Krieger 1956: 52-53), and in the southern Oregon caves (Cressman 1942: 46, 50). The technique occurs among historic Shoshonean-speaking peoples in Idaho - the Fort Hall Shoshoni and Bannock, and the Lemhi Shoshoni (Steward 1943: 16) - and also among the Nevada Shoshoni (Steward 1941: 291), the Utes (Steward 1942: 270), and the Surprise Valley Paiute (Kelly 1932: 121-122). Specimens of two-

rod foundation close coiled basketry were found in the upper levels (D IV and D V) at Danger Cave (Jennings 1957: 248) but the rods were evidently placed horizontally. Two-rod vertical or stacked foundation is reported from the southern Oregon caves (Cressman 1942: 46). This technique also occurs among the Surprise Valley Paiute (Kelly, **loc. cit.),** and Jennings (1957: 248-249) reports its presence in Ute and Shoshoni baskets in the University of Utah collections. It is also reported in Idaho among the Bannock (Weltfish 1930: 470) and the Northern Shoshoni (Lowie 1909: 178).

VII. OTHER ARTIFACTS OF VEGETABLE MATERIAL

A. Wrapped Bark Coils

The collection of artifacts from Pence-Duerig Cave includes three coils of shredded sagebrush bark fibers wrapped by additional strips of shredded sagebrush bark. Two of the coils are circular in outline, one wrapped diagonally and the other wrapped transversely by flat strips of shredded sagebrush bark. The first specimen has an outside diameter of approximately 11 cm., an inside diameter of 4 cm., and a vertical thickness of approximately 2 cm. The second specimen has an outside diameter of approximately 10.5 cm. an inside diameter of about 4 cm., and a vertical thickness of approximately 2 cm. The last specimen is oval-shaped, with a length of approximately 13 cm., a width of about 9.5 cm., and a vertical thickness of approximately 1.5 cm.

Although often called "potrests", the true use of these objects is unknown: they may have been used merely for storage of shredded bark fiber intended for cordage. A number of such coils, of juniper bark, were recovered from Promontory Cave no. 1 (Steward 1937: Pl. 6, f); and a large specimen, of sagebrush bark, was found in the Dietrich phase assemblage at Wilson Butte Cave (Gruhn 1961: Pl. 30, A).

B. Wrapped Bundles of Grass

There are four specimens of bundles of rye grass wrapped with strips of shredded sagebrush bark. The largest specimen was a bundle of rye grass approximately 21.5 cm. long, 4.0 cm. wide, and 2.5 cm. thick, wrapped at each end with flat strands of shredded sagebrush bark. At one end the sagebrush bark wrapping begins at a point about 2 cm. from the end and extends for a distance of approximately 5.5 cm., and the loose end of the wrapping is secured by being tucked under the wrapping. At the other end the bark wrapping begins at a point approximately 5 cm. from the end and extends for a distance of approximately 2.5 cm., and the end is loose. Two smaller bundles of rye grass, one approximately 19 cm. long and 3 cm. in diameter, are wrapped around the middle with a flat strand of sagebrush bark. On one of these specimens the wrapping is tied with a granny knot; on the other the wrapping was secured by twisting the two ends together. The last bundle of rye grass stalks is about 15 cm. long, 2.5 cm. wide, and 1 cm. thick; and is wrapped with a flat strand of shredded sagebrush bark at a point beginning about 4 cm. from one end and covering an area of about 4.5 cm. One end of the wrapping is loose, the other tucked under the wrapping.

C. Cordage

The collection of artifacts from Pence-Duerig Cave included a number of specimens of cordage of vegetable fibers. However, it is this part of the collection, along with the hide artifacts, which was originally placed in an exhibit case together with artifacts from another cave site near Howe, Idaho; and it must be kept in mind that some of the material to be described below may be from this other site.

1. Two-ply cordage

Eighteen specimens of cordage were of shredded sagebrush bark, 2 specimens of juniper bark, 2 specimens of a grass or sedge, and 8 specimens of an unidentified fine fiber.

The 18 strands of two-ply shredded sagebrush bark cordage ranged in length from 8 to 68 cm., with average 36.4 cm. Diameter of the cords ranged from 0.3 to 2.0 cm., with average 0.63 cm.; and diameter of the plies ranged from 0.2 to 1.0 cm., with average 0.4 cm. Often in a single cord one ply was larger than the other. Thirteen specimens were Z twist (74% of total) and 5 specimens S twist (26% of total), in all cases the direction of twist of the plies being opposite to that of the whole cord. The number of twists per centimeter ranged for ¼ to 1, and the approximate tightness of twist ranged from 30° to 63°, with average 43°.

Five specimens of two-ply sagebrush bark cordage have knots. On three specimens there is a small overhand knot at one end of the rope, perhaps to prevent unraveling, Two of these ropes with knotted ends are tied to other strands of rope, in one case by a square knot and in the other case by a granny knot.

The two specimens of juniper bark range in length from 13 to 15 cm. The approximate diameter of the cords ranges from 0.2 to 0.6 cm., and the diameter of individual plies ranges from 0.1 to 0.4 cm. One specimen is S twist, the other Z twist. The number of twists per centimeter varies from 1 to 3, and the approximate tightness of twist ranges from 38° to 52°. One specimen has a left hand overhand knot at one end.

The two strands of two-ply cordage made of twisted **Typha** or **Juncus** fiber range in length from 5 to 17 cm. The approximate diameter of the total cords ranges from 0.5 to 0.7 cm., and

the diameter of the individual plies ranges from 0.3 to 0.4 cm. Both specimens are Z twist. The number of twists per centimeter is 1, and the approximate tightness of twist ranges from 46° to 47°. No specimens had knots.

Two specimens of two-ply cordage were twisted of grass or sedge. One specimen was 10 cm. in length; the length of the other specimen, which consisted of two strands tied together in a complex knot illustrated in Fig. 5, H, could not be determined. In all specimens the diameter of the cord was 0.2 cm., and the diameter of the plies 0.1 cm. All specimens were Z twist, with 3 twists per centimeter. The tightness of twist varied from 40° to 45°.

The 8 specimens of two-ply cordage made of an unidentified fine fibre (two specimens consist of 2 or 4 strands knotted together) range in length from 6 to 17 cm. The approximate diameters of the cords range from 0.1 to 0.3 cm., and the diameters of the individual plies range from 0.05 to 0.1 cm. All strands are S twist. The number of twists per centimeter ranges from 2 to 8 cm.; and the tightness of twist ranges for 40° to 72°. In one case two strands are tied together by an unidentified knot (Fig. 5, I). In another case three separate strands each about 9 to 12 cm. long are wrapped and tied with a 17 cm. long strand in a left-hand overhand knot.

2. Knotted Bark Strands

The collection of artifacts from Pence-Duerig Cave includes a total of 15 specimens of flat sagebrush bark strands tied with various kinds of knots. Approximate total lengths of the specimens range from 6 to 40 cm., and widths of the individual strands ranges from 0.4 to 1.5 cm. Four single strands each have a left hand overhand knot, one specimen enclosing a loop; six pairs of strands are tied together with granny knots; four pairs are tied together with square knots, and one is tied with a complex knot which could not be analyzed. On two specimens the end of one strand is charred. One specimen has a small thin twig incorporated in the knot.

VIII. ARTIFACTS OF HIDE

As in the case of the cordage of vegetable fibers, the artifacts of hide from Pence-Duerig Cave may have been mixed with a collection of material from another cave site near Howe, Idaho. Therefore although descriptive data on all this material will be presented below, one must hold the reservation that some of the material may be from the cave near Howe. The moccasins, at least, probably came from Pence-Duerig Cave, as the horizontal locations of three moccasins are shown in a roughly sketched plan of the cave in the field notes.

A. Moccasins

The collection includes three complete moccasins and three fragments of moccasins. The complete specimens are all evidently made of one piece of bison hide with tufts of hair still adhering in scattered patches. On two complete specimens the hairy side is outside, on one specimen inside.

The first complete one-piece moccasin (4482), the one specimen with hair inside, is about 22 cm. long (Fig. 6, C). It has a seam approximately 6.5 cm. long across the toe, and is laced from the center of this seam over the instep up to the ankle with a two-ply cord of sinew in a running stitch. The heel section of the moccasin is badly folded but seems to have a straight stitched heel seam, reaching about ankle height, and ankle flaps.

Another single-piece soft-soled moccasin (4483) is a "hock" moccasin, made of the skin from the rear knee (Fig. 6, B). It has a straight toe seam about 7 cm. long sewed with a two-ply sinew cord in a running stitch. About 3 cm. behind the toe seam is another slit 5.5 cm. long that runs parallel to the toe seam to the side of the moccasin and then curves toward the rear. This seam is also stitched with two-ply sinew cord in a running stitch. The split over the instep is laced with a buckskin strap. The heel part, 8 cm. high, is folded and compressed but apparently has no heel seam. Halfway up the heel a rawhide strap runs above the heel around and below the ankle, passing through a small slit on either side. It was presumably tied over the instep. The moccasin is lined in the interior with shredded sagebrush bark.

The last complete one-piece soft-soled moccasin (4484), 24 cm. long, has scattered patches of hair on the sole (Fig. 6, A). It is also a "hock" moccasin. At present this specimen is compressed and the upper surface is curled over. There is a toe seam approximately 10 cm. long stitched with sinew cord in a running stitch secured at both ends by an overhand knot. No special features of the heel and instep region can be observed.

Two of the three fragments of moccasins are badly disintegrated. One specimen about 26 cm. long, is evidently a one-piece type with a cord for tightening running through slits all around the foot. This moccasin was lined with sagebrush bark. Another badly disintegrated fragment of a moccasin is about 21 cm. long. The only discernable features are a toe seam about 10 cm. long stitched with sinew cord, and a lining of shredded sagebrush bark. The last fragment is part of the heel of a hide moccasin with some traces of a shredded sagebrush bark lining.

It is interesting to contrast the Pence-Duerig style of single-piece, soft-soled moccasin with a moccasin of three-piece construction recovered from the upper levels at Wilson Butte Cave

(Gruhn 1961: Chapter V and Appendix F). The Wilson Butte Cave specimen has a one-piece body, a separate hard rawhide sole, and an attached vamp or ankle piece. The basic pattern of the body is very similar to that of Pence-Duerig specimen #4482, with a cross-toe seam and an instep seam. There is reference in ethnographic literature on the Snake River Shoshoni to the occasional addition of a vamp or ankle flap to a single-piece moccasin for warmth or protection (Steward 1941: 301, 344). It is possible that the separate hard rawhide sole of the Wilson Butte Cave moccasin may also be an optional addition to the basic one-piece body pattern: Steward (1941: 246) mentions that among the Nevada Shoshoni a hard sole was sometimes added to a "1-piece" moccasin.

B. Pieces of Rawhide

The collection includes a total of 6 unmodified pieces of rawhide. Two of the specimens are large pieces of scraped bison hide with some hair still adhering. One is roughly triangular-shaped, with a length of approximately 44 cm. and a maximum width of 23 cm.; the other is roughly oblong-shaped, with a length of approximately 54 cm. and a maximum width of 25 cm. Three more specimens are small, roughly oblong, pieces of scraped rawhide probably bison, varying in length from 15 to 18 cm. and in width from 8 to 10 cm. The last specimen is a ring-shaped piece of scraped rawhide evidently cut from the leg of a large mammal. The piece is now hard and compressed, and measures about 7.5 cm. in width and 4.1 cm. in length on one side and 8 cm. in length on the other.

One large piece of rawhide has slits cut in the edge evidently for stretching. This specimen is a large, roughly oval-shaped piece of scraped bison hide with a few tufts of hair left. It was evidently torn off from a piece originally much larger, and now measures approximately 59 cm. in length and 32 cm. in maximum width. The edge of the piece opposite the torn edge has three slits 3 to 5 cm. long spaced at intervals of 15 to 20 cm.; and pulled out from the piece, indicating a fastening of some sort.

Three rawhide strips have similar slits. One specimen is an unevenly cut strip of dehaired rawhide, possibly deerskin, about 97 cm. long and 3 to 5 cm. wide, evidently a cut-off edge of a stretched hide. There are six distorted slits, varying in length from 2.2 to 4.3 cm., spaced at irregular intervals a distance of about 1 cm. from the outside edge of the hide. One side of the hide has traces of dark red paint. Another unevenly cut strip of dehaired rawhide, possibly deerskin, is 26 cm. long and 2.5 cm. wide at the center, broadening to a width of about 4.5 cm. at the ends. At one end there is a stretched longitudinal slit 5 cm. long, and at the opposite end a stretched transverse slit 3.5 cm. long. The last specimen is an unevenly cut, twisted strip of dehaired heavy rawhide about 50 cm. long and 1 to 4 cm. wide, with a slit 6.6 cm. long stretched into a loop. Similar pieces and strips of rawhide with stretched loops were found in Promontory Cave no. 1 (Steward 1937: Fig. 25, a. d, e; Fig 26).

The collection also includes six long, thin, unevenly cut strips of heavy dehaired rawhide. Two specimens have evidently been folded over lengthwise. One is approximately 38 cm. long and 1 to 3 cm. wide; the other is 27 cm. long and 1 to 4.5 cm. wide. Two other specimens are partly twisted. One is approximately 67 cm. long and 0.5 to 1 cm. wide; the other is approximately 66 cm. long and also 0.5 to 1 cm. wide. Another strip, 57 cm. long and 0.7 to 2.5 cm. wide, is unmodified. The last specimen is an unevenly cut strip, about 1 cm wide, of thick dehaired rawhide split at one end into two prongs, one 6 cm. long and the other 15 cm. long. The distance from the unsplit end to the fork is about 20 cm.

A unique rawhide specimen is an object comprised of two thongs of rawhide, the shorter 11 cm. long and 2 cm. wide, the other split into two strips of indeterminable length. One of the strips of the split thong is looped around the middle of the first thong and then interlaced with the second strip in three loops to form a plaited portion 3 cm. long and 2 cm. wide, ending in the two loose ends of the split thong.

Another unusual specimen is an unevenly cut strip of rawhide, 35 cm. long and 0.5 to 1.2 cm. wide, with patches of hair still adhering. It is tied in two places with left hand overhand knots, the smaller of which has incorporated a strand of shredded sagebrush bark about 15 cm. long, evidently part of a connecting rope.

C. Soft Hide Thongs

The collection includes three short, thin, untwisted thongs of soft hide evidently cured. One is 9.6 cm. long and 0.3 cm. wide. Another, which is about 12 cm. long and 0.3 cm. wide, bears traces of white paint. The last specimen, which has some hair still adhering, is approximately 15.5 cm. long and 0.2 to 0.8 cm. wide.

D. Rabbit Fur Cordage

The collection includes a total of 11 thin strips of hide evidently rabbit, with fur still adhering on 5 specimens. They are probably fragments of twisted rabbit fur blankets. All are two-ply and Z twist. Lengths of the fragments ranged from 10 to 35 cm., with the average 22.8 cm. Diameter of the cords varied from 0.1 to 2.5 cm., with an average of 0.5 cm.; and plies varied in diameter from 0.1 to 1.0 cm., averaging 0.3 cm. Except in four cases, the number of twists per centimeter and the degree of tightness of twist

varied along the length of the individual specimens: most were loosely twisted, with space between the plies. One specimen has a 2-ply S twist string of shredded sagebrush bark cordage 30 cm. long and 0.2 cm. in diameter attached to one end with a square knot.

Also included in the collection are three thin, unevenly twisted strips of soft hide with hair still adhering. These appear to be rabbit skin, and may be parts of blankets. One specimen, about 20 cm. long and 0.2 to 0.9 cm. wide, has a Z twist. Another strip, 18 cm. long and 0.5 cm. in width, also has a Z twist, with a diameter of 0.2 cm. The last specimen is approximately 12 cm. long and 2.5 cm. in maximum width, and also has a Z twist.

E. Sinew Cordage

The collection included two fragments of two-ply S twist cordage made of numerous long, fine strands of sinew. One specimen is approximately 45 cm. long. The cord has a diameter of approximately 0.3 cm. and the plies a diameter of about 0.15 cm. The other specimen is 20.8 cm. long. The cord has a diameter of approximately 1 to 2 cm. and the plies a diameter of about 0.1 cm. This specimen has an overhand knot at one end; and the opposite end is very narrow, possibly to facilitate threading. On both specimens the number of twists per centimeter and the tightness of twist varies along the length of the cord; in general the twist is loose, with space visible between the plies.

IX. CONCLUSION

A. Summary

The collection of artifacts described in this report were recovered by excavations in 1937 at the site of Pence-Duerig Cave, which is located in an alcove or box canyon along the north rim of the Snake River Canyon in Jerome County, south-central Idaho. The collection is now in storage at the Idaho State College Museum, Pocatello.

The excavations at Pence-Duerig Cave although carried out by college personnel were very poorly recorded, and the artifacts are without definite provenience. The available field notes suggest, however, that virtually all of the material was recovered from the upper layer of the cave deposits. This upper layer, called Layer 2, was 2 to 8 inches thick; and consisted largely of bark, grass, and twigs probably brought into the cave by the prehistoric inhabitants to serve as bedding material. Food refuse included in this deposit indicates that the subsistence economy was varied in nature, with hunting of bison, deer or antelope, and small rodents; gathering of juniper berries and grass seeds; fishing; and collecting of crayfish and river mussels.

Perishable artifacts of wood, vegetable fibers, and hide in the collection can probably be assigned to this dry deposit. The wooden artifacts included shafts, wooden hoops, pieces of twisted willow wood, and a variety of miscellaneous items. Other artifacts of vegetable material were cordage, coiled basketry, wrapped bark coils, and wrapped bundles of grass. Artifacts of hide included several single-piece soft-soled moccasins, strips and pieces of rawhide, sinew cordage, and strips of rabbit fur, probably parts of rabbit fur blankets. It also seems probable that all of the bone artifacts, including awls, gaming pieces, and a variety of other items, were also recovered from this layer.

Most of the stone artifacts also presumably were recovered from this same layer. Ground stone artifacts included shallow mortars and pestles, manos and slab milling stones, shaftsmoothers, tubular pipes, shaped pieces of red hematite, and miscellaneous items. The chipped stone artifacts included projectile points, knife blades, drills, and scrapers. The major part of the collection of projectile points from Pence-Duerig Cave are the small triangular, side-notched, or corner-notched and barbed forms generally late prehistoric types throughout the West, and their provenience in the upper levels of the site is to be expected. However, two types, one with broad leaf-shaped blade and concave base (Type 2), the other with a long thick blade and long broad stem (Type 8), seem to be older forms; and it is suspected that these specimens were recovered from the underlying loess or sand deposits but were not recorded.

B. Discussion

With the exception of the above mentioned early point types, the collection of artifacts from Pence-Duerig Cave appears to represent a late prehistoric phase of the Great Basin Desert Culture, as a number of the attributes listed by Jennings (1957: 280-281) are present. Many items present in the assemblage - coarse thick-walled pottery, coiled basketry of one-rod or two-rod foundation, composite firedrills, single-piece soft-soled moccasins, wrapped bark coils, rabbit fur blankets, manos and milling stones, mortars and pestles - would identify the late prehistoric occupants of the site as Shoshonean (**cf.** Gruhn 1961: Chapter VII).

In the descriptive sections comparisons have been made between specific artifacts in the collection from Pence-Duerig Cave and artifacts from major Great Basin sites to the south and west. In Idaho not much fully documented archaeological material is available for comparisons. Artifacts described by Swanson, Tuohy, and Bryan (1959) are from surface collections made in the process of an extensive site survey in south and central Idaho. The number of excavations which have

been published is at present extremely limited (Sites 10 JE 7, 10 AA 15). The Mecham site (10 JE 7), a burial in a small rockshelter along the north rim of the Snake River Canyon near Shoshone Falls (Gruhn 1960), was located only about two miles downstream from the Devils Corral; but no artifacts comparable to Pence-Duerig Cave specimens were included in the burial assemblages, and I believe the Mecham site burial is somewhat earlier than the bulk of the Pence-Duerig Cave material. Excavations by the Idaho State College Museum in a small rockshelter (Site 10 AA 15) much further downstream along the Snake River, in Ada County, yielded very few artifacts; but small triangular side-notched and corner-notched points similar to Pence-Duerig forms; and sherds of Shoshoni pottery, were found in the upper levels (Tuohy and Swanson 1960).

The collection of artifacts from Pence-Duerig Cave shows a number of similarities to late prehistoric material excavated at Wilson Butte Cave (Site 10 JE 6), which is located out on the Snake River Plain in the northeast part of Jerome County, about 20 miles from Pence-Duerig Cave (Gruhn 1961). As at Pence-Duerig Cave, the upper levels at this site (Stratum A) were composed of dry bedding materials such as bark, twigs, and grass; the occupation represented in this stratum has been designated the Dietrich phase. Artifact similarities between the Pence-Duerig collection and the Dietrich phase assemblage include triangular points, small corner-notched points and small side-notched points; small bone gaming pieces; splinter awls; cordage of shredded sagebrush bark and fine fiber; knotted bark strands; composite and single shaft arrows; composite firedrills; wrapped bark coils; and tubular pipes.

There are, however, some significant differences between the Pence-Duerig Cave collections and the Dietrich phase assemblage. No fragments of basketry or rabbit fur blankets were found at Wilson Butte Cave. The leather moccasin associated with the Dietrich phase was of three-piece construction, with a separate hard rawhide sole and attached vamp or ankle flap, as contrasted with the single-piece construction of Pence-Duerig moccasins. Wilson Butte Plain ware, although also a type of Shoshonean pottery, is different from that of Pence-Duerig Cave in being relatively thin-walled, with moderate tempering.

In the Wilson Butte Cave report it was suggested that the Dietrich phase may represent seasonal encampments of small groups of prehistoric Shoshonean people who were out on the plain to hunt bison, probably at a certain time of year (Gruhn 1961: Chapters VI and VII). This hypothesis was largely based on ethnographic accounts of seasonal economic specializations by wide-ranging groups of Idaho Shoshoni in the early historic period (**cf.** Steward 1938. Liljeblad 1957, Murphy and Murphy 1960). It is believed that in such a situation the artifacts found at the site would represent only one seasonal facies of the total economic pattern of the prehistoric group, in this case, intensive hunting activity; and this may explain the absence of equipment for a seed-gathering economy such as basketry implements and containers, and food-grinding implements, in the Dietrich phase assemblage.

Thus some of the differences between the Pence-Duerig Cave collection and the Dietrich phase assemblage at Wilson Butte Cave may be a reflection of economic factors, but other differences between the two assemblages cannot be ascribed to such factors. The difference between the moccasin types and pottery types are stylistic in nature, and would suggest that two distinct although culturally related social groups are represented at the different sites. The differences may be comparable in scope to those between the several major regional Shoshoni groups which were distinguished in southern Idaho in the early historic period.

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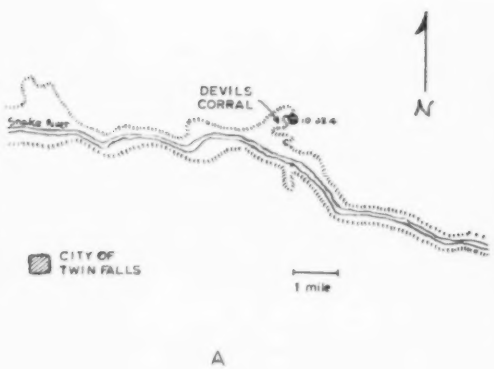


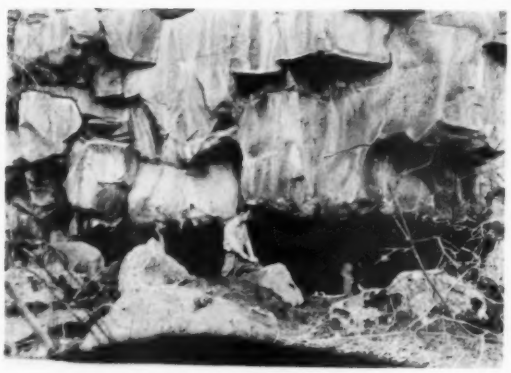


Fig. 1: A, Map showing location of Pence-Duerig Cave (Site 10 JE 4). B, Mouth of Pence-Duerig Cave in 1937.

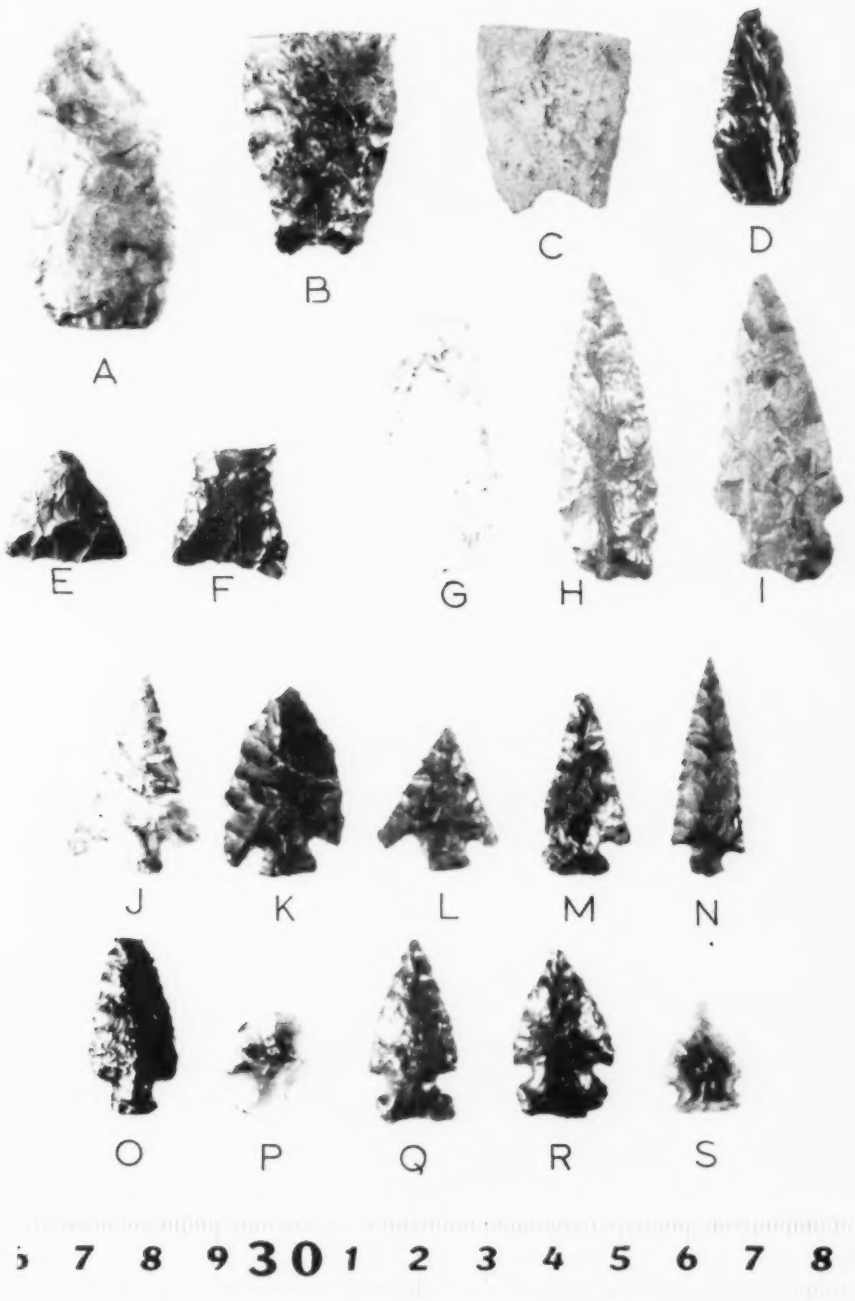


Fig. 2: Projectile Points. A, Type 1. B-C, Type 2. D, Type 3. E, Type 4. F, Type 5. G, Type 6. H, Type 7. I, Type 8. J, Type 10a. K, Type 9. L-M, Type 10b. N-P, Type 10c. Q-S, Type 11. Photographs by B. Robert Butler.

Fig. 3: A - B, Drills or perforators. C, Hafted stone perforator. D, Endscraper. E, Crescent. F - G, Small thick bifaces. H, Handled stone blade wrapped with sagebrush bark strands. Photographs by B. Robert Butler.

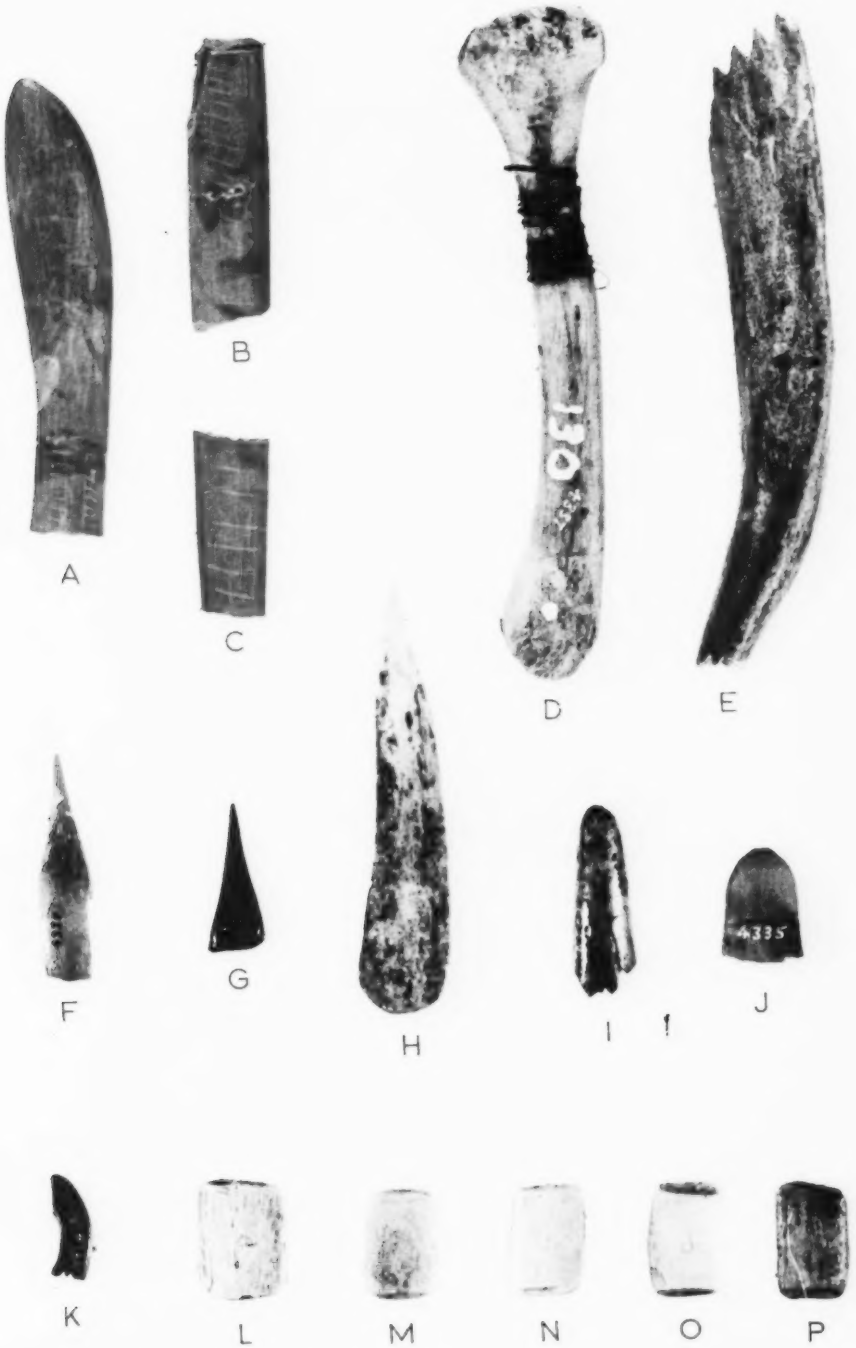


Fig. 4: A - C, Fragments of incised bone shaft. D, Reel-shaped bone object. E, Notched antler shaft. F - G, Bone awl points. H, Bone splinter awl. I, Blunt bone point. J, Flat bone object. K, Drilled rodent incisor. L - P, bone dice. Photographs by B. Robert Butler.

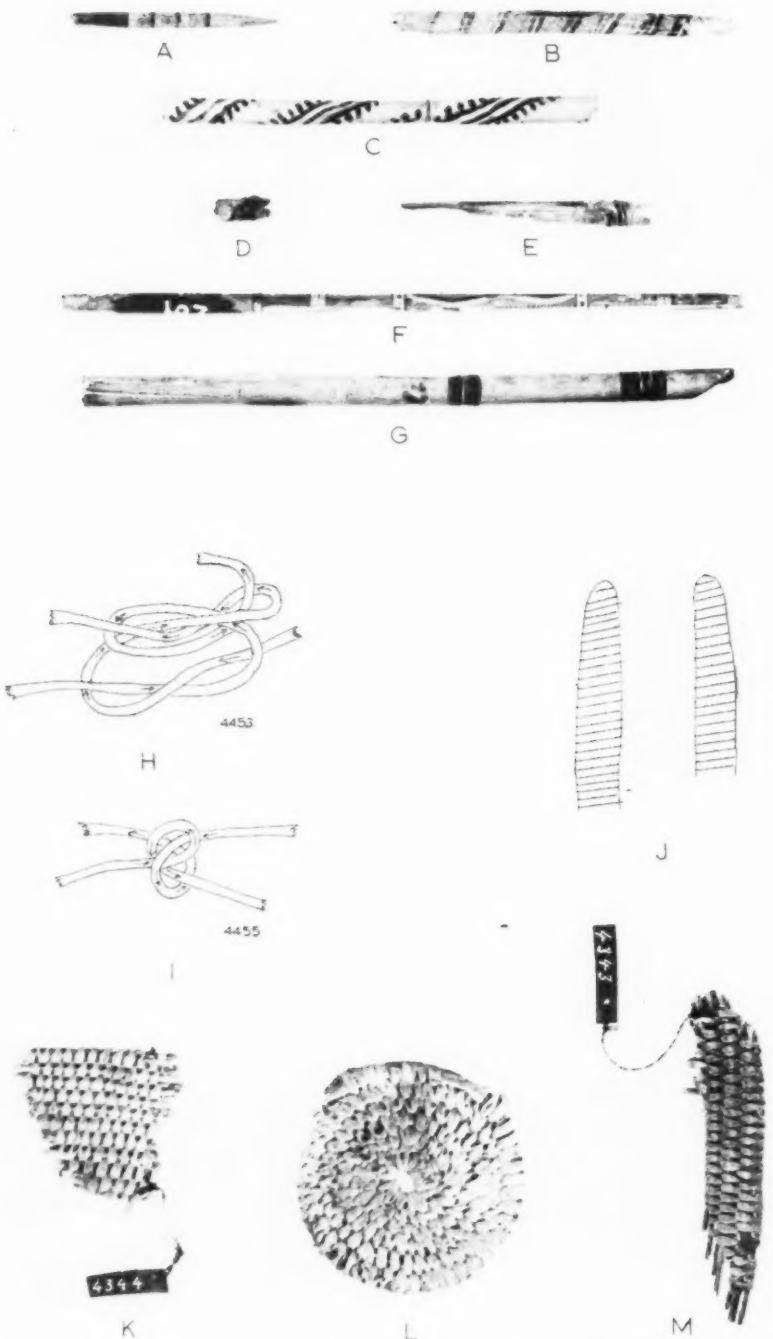
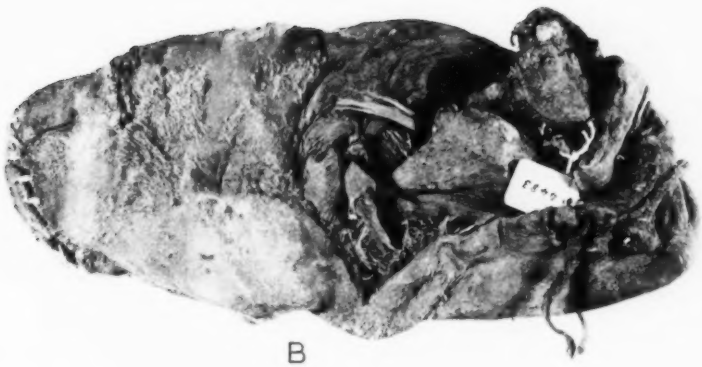


Fig. 5: A - B, Painted wooden points. C, Cane arrow mainshaft decorated with pyrographic design. D - E, Nock end of cane arrow mainshafts. F, Painted wooden arrowshaft. G, Painted wooden shaft. H - I, Diagrams of knots in cordage specimens. J, Cross-section of rim sherds. K - L, Fragments of coiled basketry. Photographs by B. Robert Butler.

A



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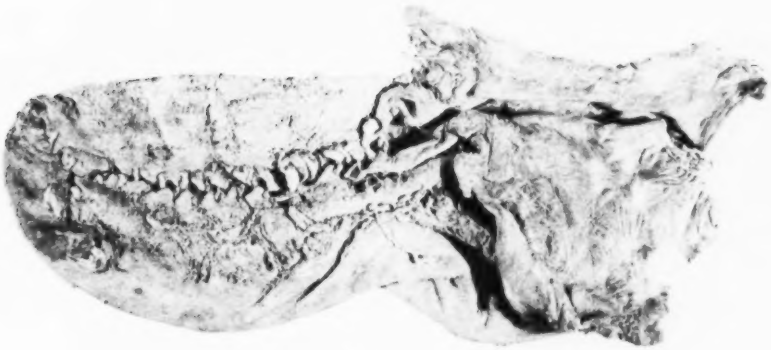

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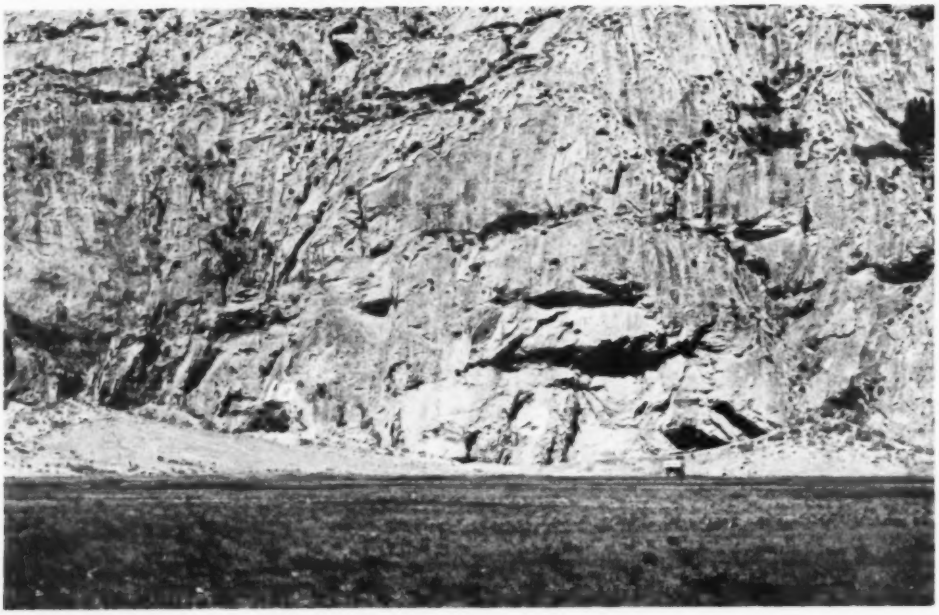
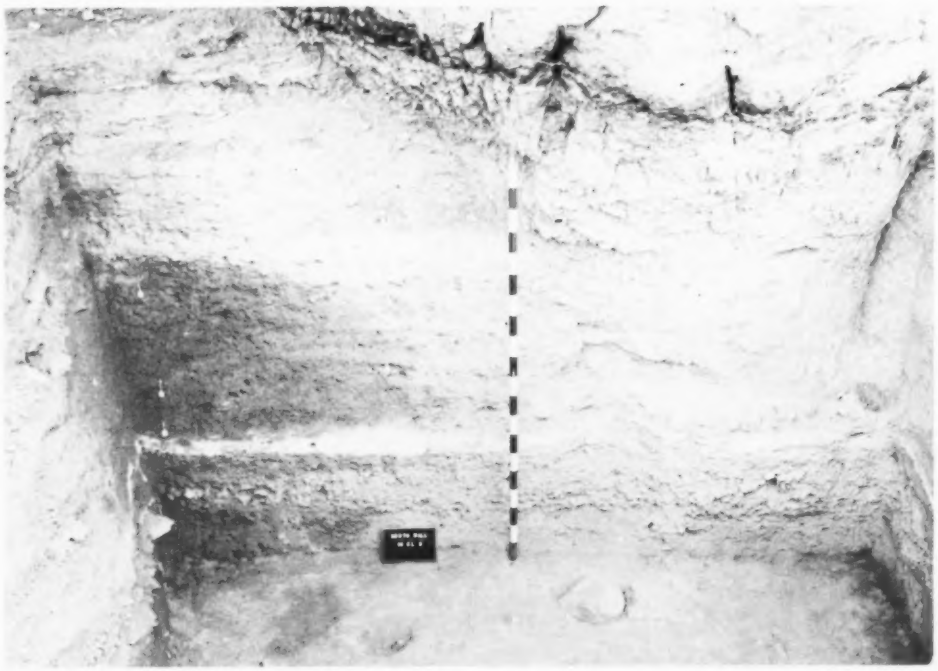
Fig. 6: A - C, Moccasins. D, Plaited wooden object. Photographs by B. Robert Butler.



Rockshelters 10-CL-10 and 10-CL-3, Birch Creek, showing position with reference to the alluvial fans. View from the southwest.



Section illustrating the stratigraphy in 10-CL-3. Note the volcanic ash 60 cms. above the base of the section.

Preliminary Report on Archaeology in the Birch Creek Valley, Eastern Idaho

by Earl H. Swanson, Jr.

In 1960 the Idaho State College Museum conducted excavations in a series of rockshelters in the Birch Creek Valley of eastern Idaho. The project was supported by a National Science Foundation grant of $13,000. The Birch Creek rockshelters are situated approximately 125 miles north-northwest of Pocatello; and are located in a high, open mountain valley at a height above sea level of some 6200 to 7100 feet. Excavations were carried on for a period of ten weeks and produced results which were largely in accord with the planning reported in the January, 1960, proposal for support from the National Science Foundation.

The selection of the area for exploration was based upon extensive surveys in 1958 (Swanson, **et. al.** 1959); upon an intensive survey in southwestern Idaho, 1959 (Swanson, **et. al.,** n. d.); and upon excavations carried out at Wilson Butte Cave in south-central Idaho by a joint Idaho State College Museum-Peabody Museum (Harvard University) expedition (Gruhn 1961). Information then at hand indicated the strong possibility we would obtain a long chronological sequence which might serve as the framework for prehistory in eastern Idaho.

Secondly, there are in this area a number of diverse kinds of sites which offered the opportunity of obtaining specific information. Thirdly, the distribution of pottery and Folsom-Yuma points (Swanson, 1961) is confined to the Snake River Plain south of the Birch Creek Valley. We might expect, therefore, a different early cultural tradition in the Birch Creek Valley; this has proved to be true. Further, we were interested in the problems surrounding the origins and development of the Northern Shoshoni, who might have played an important role in the genesis of Plains culture. Finally, we were interested in problems of general relationships of this region to the Plateau, Plains, and the Great Basin.

Camp was established near Blue Dome approximately 400 yards from the major concentration of rockshelters in the east cliff face flanking Birch Creek. Four rockshelters were selected for excavation. Each of these sites is located in a different topographical position. We expected by this procedure to obtain checks of the stratigraphic sequences. This expectation was borne out by the results. One small rockshelter proved, however, to be of little value culturally or stratigraphically; but it did help us to elminate certain kinds of rockshelters from further consideration. This shelter, 10-CL-9, like all others, occurs in Paleozoic limestone; but, unlike those shelters which possess real evidence of prehistoric occupation by man, it is a tube-like arrangement resulting from internal water flow in the limestone. The shelters which show evidence of intensive occupation are all stream-cut, either by Birch Creek or by the small tributary which flowed through Skull Canyon. The deposits in one of these shelters, 10-CL-11, accumulated principally as a consequence of stream action. The two most important shelters, 10-CL-3 and 10-CL-10, occupy positions with reference to alluvial fans. The deposits within these sites were built up principally through functioning of these fans over a relatively long period of time.

From the last three shelters good information has been obtained on the physical stratigraphy of the rockshelters, although this information is not yet complete. In exploring 10-CL-3, we began by laying out a trench parallel to the cliff face, connecting flanks of the two fans whose deposits interleave and fill the shelter. Later expansion of one end of this trench was undertaken to obtain data on features and to explore two small grottoes in the main face.

In 10-CL-10 we first opened a large horizontal area to find more data on late cultural occupations missing in 10-CL-3; and then pushed a pier to bedrock some 6.3 meters below the surface. In this instance, a single pier was pushed to bedrock in order to be sure of obtaining at least one complete stratigraphic sequence before the close of the excavations. In 10-CL-11, in Skull Canyon, a checkerboard series of tests pits was laid out and excavated in order to establish the character of the deposits and the location of bedrock, because it was not possible to determine the nature of the floor of the shelter from the surface. In 10-CL-3 and 10-CL-10 the location of bedrock could be estimated because of a fault line visible in the overhang above these two shelters.

The deposits in all three rockshelters were finely stratified, and our excavation procedure was to trowel and to peel each layer. In 10-CL-3, some of the layers were composed of angular fan gravel and were screened as well. This procedure has provided us with a minute check on the possibilities of cultural change in these shelters.

At the time excavations were begun, a resurvey of Birch Creek was undertaken, with the result that twelve new sites were discovered. In addition, a traverse was made across the terraces

lying between the cave and the present course of Birch Creek. Encouragement was given to an intelligent group of amateurs who were surveying the beaches of Mud Lake, once a lake of considerable size and probably of Pleistocene or early post-Valders age. Several sites of special interest recorded by these procedures will be examined in 1961 (see below).

An estimate of the age of the deposits has been made, based upon geological evidence so far obtained. Analysis of all information obtained has not yet been completed, but field observations permit us to make a reasonable estimate as to the geological periods into which the sequence of the sediments falls. Similar situations in Montana, in British Columbia, eastern Washington, and south-central Idaho are available for comparison. Several of the localities being used for comparative information have available detailed soils analyses and, in some instances, radiocarbon dates. A review of all of these will not be made here, but the tentative estimates given below have been made with such comparitive localities in mind.

The deposits in the two shelters containing our principal cultural information to date (10-CL-3 and 10-CL-10) are the result of the actions of two alluvial fans. The fans appear to represent functioning geological processes which have continued over a relatively long period of time. The excavation of the two shelters exposed the entire fan sequence at two different points. One, in 10-CL-10, exposed the sequence midway down one of the two fans; the excavation in 10-CL-3 provided sections from the edges of both of the fans which flank that site. The deposits in 10-CL-3 can be correlated with some exactness with those in 10-CL-10. At the base of the sequence in both shelters lies a river-deposited gravel and loam. This gravel is part of an old stream channel of Birch Creek at a time when it flowed against the face of the cliff and undercut the face in such a way as to produce the two shelters, 10-CL-3 and 10-CL-10.

On the opposite side of the stream channel from the cliff face and the shelters are two and possibly three stream terraces, which we propose to study in some detail in the season of 1961. As yet, the age of this stream gravel cannot be established; although it seems likely that it may correspond with the early Anathermal period. The work of Dr. Wakefield Dort, Pleistocene geologist from the University of Kansas, will be of considerable value in establishing the antiquity of these gravels.

Above the gravels are a sequence of alluvial fan deposits, finely stratified, and with some alternating characteristics. The earliest layer in 10-CL-3 appears to be of late Anathermal age. It is succeeded by a second layer, which may also be Anathermal in age; and then by a layer of volcanic ash on which is bedded a deposit of ~~organic~~ orange clay above which is a second deposit of yellow clay. The clay is derived from the cliffs above the shelters, where it constitutes the native clay formed on the limestone. At the present time there is good soil (a chestnut soil, indicating approximately 15 inches of rainfall per year) and adequate plant cover to prevent erosion. The fact that these two clay horizons could be widely distributed at the edge of the fans suggests a seriously reduced plant cover, if present at all; and widespread sheet erosion. These appear to represent Altithermal deposits. Above the clay deposits are a series of beds composed of small-to-fine angular gravel and quantities of brown silt resembling that which is deposited at the present time. The silts in these layers appear to be somewhat coarser than those available at the present time, but no quantitative analysis has yet been made.

These later gravel beds appear to represent the earlier portions of Medithermal time. Beginning with layer 24 and going upward in the sequence, there are coarse, angular fan gravels with very little silt; and these may represent drought conditions late in Medithermal times. Above this are the most recent layers with small-to-medium angular gravel, brown silt, and at the very top, substantial layers of cow dung which appear to date first from A.D. 1885 when large numbers of cattle were first placed on this ranch.

Associated with the apparent Altithermal deposits is the layer of volcanic ash which may belong either to the Glacier Peak eruption (ca. 6700 B. P.) or Mount Mazama (ca. 7600 B.P.). Identification of the ash is being undertaken by the United States Geological Survey office in Denver.

There is a striking parallel with 10-CL-3 in the deposits of 10-CL-10. In 10-CL-10 the deposits are much deeper and there is a finer stratification of the silt and clay sediment. There is a greater quantity of fine sediment at the flank of the apex of the cone, as might be expected. This increase in fine silt and clay is apparently due to continuing seepage in 10-CL-10. There are also two thick fan gravel layers which correspond to the gravel layers in 10-CL-3. The earliest fan gravel at 10-CL-10 is comparable in every way with the earliest fan gravel deposits in 10-CL-3. In addition, the volcanic ash is present in the same relative stratigraphic position in 10-CL-10 as in 10-CL-3; and in 10-CL-10 a substantial charcoal sample was found to be inclusive in the volcanic ash. This sample is currently being dated at the University of California, Los Angeles.

Artifacts occur throughout the deposits at both sites, and there are some significant cultural changes associated with the climatic changes suggested above. Sufficient radiocarbon samples were obtained; so that we should be able to check the geological estimates with some precision.

The material culture of the rockshelters is pri-

marily that which may be associated with hunting activities of small groups of men. Projectile points, knives, crude lamellar blades and scrapers, a number of retouched flakes, and some large scraping and cutting tools were found during the course of the excavations. 10-CL-3 showed the greatest concentration of occupation during the Anathermal and early Medithermal times; whereas 10-CL-10 showed the greatest concentration of artifacts, bones, and other materials from later Medithermal time. The reason for the variation in occupation of these two adjacent shelters is not yet clear, but it does suggest some problems.

The Anathermal deposits in 10-CL-3 (Level 30) contained leaf-shaped, lanceolate, and triangular side-notched point forms. In addition, one large, stemmed point was found which has a shape and characteristics which may be within the range of point forms discovered at Palli Aike. It is noteworthy that most of the leaf-shaped and lanceolate points which dominate the material of this deposit appear to have been snapped off either midway or nearly two-thirds down from the point. The leaf points appear to be Cascade points characteristic of the Old Cordilleran Culture (Butler, 1961). Triangular side-notched points continue throughout the cave sequence, becoming markedly smaller and more finely made in late prehistoric times. These are the most common points in the Altithermal deposits.

Leaf-shaped points are confined to the Anathermal sediments. Corner-notched points appear with the beginning of Medithermal sediments and continue into later prehistoric times, but they do not appear to reach a protohistoric period. At the beginning of Medithermal time, three lanceolate points are also present; but, apart from these three, the lanceolate forms are otherwise confined to level 30. A few other point forms have been recovered, but to date they are not common enough to evaluate their significance.

Virtually the only finished type of scraper present from Birch Creek sites is a flake end scraper, and it is found most commonly in Anathermal and Altithermal beds. Crude lamellar blades are confined to Medithermal deposits, and retouched flakes of irregular form occurred throughout. Larger, percussion-flaked scrapers and an occasional chopper are found principally in Altithermal and earlier horizons.

Cultural items which would indicate domestic life are missing from the artifact assemblage. Awls, needles, and other household items simply do not appear in the collections. A few gravers, but no true burins were recovered; and no pottery is known from the Birch Creek Valley.

The full extent of the relationships of the prehistory of the Birch Creek Valley has not been worked out as yet. It is apparent, however, that a different early cultural tradition exists on the Snake River Plain from that which is known from the higher valleys of eastern and central Idaho, such as Birch Creek. Folsom and Eden-Scottsbluff points are well known on the Snake River Plain, but they are not generally found in the adjacent foothill and mountain region. Several Folsom stations are known at the Lost River Sinks on the northern edge of the Snake River Plain, and it is into these sinks that Birch Creek empties. One aspect of the 1961 program will be to explore the Lost River Sinks to see if a site can be found where there is an overlap of Folsom with Cascade and triangular side-notched points. Some work has already been initiated at Mud Lake, which lies on the northern edge of the Snake River Plain to the east of the Lost River Sinks. This lake, now dry except for irrigation water, has produced evidence suggestive of just such an overlapping situation.

The 1961 program is planned to accomplish several things. In the first place, expansion of the excavation at both 10-CL-3 and 10-CL-10 is necessary in order to fill out the cultural sequence and to obtain more geological and soils data for evaluation of the prehistoric environments. Secondly, testing of the river terraces opposite the caves is planned in order to obtain an alluvial sequence which may be related to the sequence in the caves. Further, if Dr. Wakefield Dort is able to continue his work, study of the alluvial deposits will be necessary in order to relate the terraces of Birch Creek to the Pleistocene sequence being worked out in the Lemhi Range by Dr. Dort.

Thirdly, we hope to obtain detailed information on both modern and fossil soils. Fourthly, we plan to test several apparently specialized open sites in the valley. One of these sites is a pine ridge where prehistoric occupation took place; another is associated with wild iris (**Iris missouriensis**), which is known to have been used by the historic Indian people of the area. Survey of the Lost River Sinks and the mouth of Birch Creek is also planned in order to see if relationships between the cultural history of the Snake River Plain and that of the Birch Creek Valley can be established. The only known pottery site in this area lies at the mouth of Birch Creek on the edge of the Lost River Sinks, and we would hope to examine this site in some detail to see what differences there may be between this and the other known sites of the Birch Creek Valley, where no pottery is known.

Except for work of perhaps a more specialized nature, we would hope to complete the major aspects of our program in the Birch Creek Valley during the summer season of 1961; so that a final and comprehensive report may be prepared for publication during the winter of 1961-62.

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Additional Notes and Comments on Atlatl Weights in the Northwest

by B. Robert Butler

The notes and comments presented in this article are intended to serve as addenda to the Butler and Osborne (1959) paper on the occurrence and distribution of ground stone atlatl weights in the Northwest published in **American Antiquity** a few years ago. In that paper, the weights were grouped into three main types largely on the basis of the number and location of the lashing grooves, notches, holes, or scars (**Ibid:** 215). Among the specimens which were studied at the time, the correlation between form and method of lashing was quite high.

The Type Ia weight was a narrow, more or less flat-sided hemisphere with a single transverse perforation through the center of the sides. The base of this type was nearly always flat. The Type II weight was usually a rather long, boat-shaped object with a single transverse notch over either of the narrow, tapered ends. The base was either flat or slightly concave and turned up slightly at the ends, presumably so that tightening wedges could be driven under the ends after the piece had been lashed to the underside of the throwing board. This feature was also common on the Type IIIa specimens, which were shorter, almost loaf-shaped objects with a three-quarter groove around the midsection; **i. e.,** with a groove up the sides and over the top of the midsection. The better made Type IIIa specimens usually had a concave base; however, flat-based specimens were not uncommon. This type was the most common of the three, particularly in the Lower Columbia Valley, and also tended to be the heaviest. Weight alone was not considered a very satisfactory criterion for classification of the three types because there was considerable overlap in their weight ranges. However, there was a rather high correlation between the average weights of the specimens and the types to which they were assigned. Type Ia weights had an average weight of 105 grams; Type II, an average of 55 grams; and Type IIIa, an average of 174 grams (Butler and Osborne 1959: Table 1).

In the Butler and Osborne paper, reference was made to reports of galena atlatl weights found along the banks of the Pend Oreille and Coeur d'Alene rivers in northern Idaho; but the reports were not confirmed at the time, nor did we have any idea as to the type or types involved (**Ibid:** 216). Since then I have learned from Mr. Tom O. Miller, Jr., who has worked in northern Idaho, that these weights are identical to the Type Ia weights described and illustrated in the Butler and Osborne paper (**Ibid:** 215 - 216 and Fig. 1, a - d), most of which were also made of galena. The latter were mainly concentrated in The Dalles Region of the Lower Columbia Valley, as were also the Type II and Type IIIa weights. The nearest source of galena to The Dalles was along the western slopes of the Cascades in Oregon and Washington. In the Pend Oreille country of northern Idaho, large deposits of galena are common; and this fact, coupled with the type of atlatl weight found there, suggests an alternative source for the material from The Dalles and perhaps for the finished galena weights found there as well. Mr. Miller observed neither Type II nor Type IIIa weights in the collections from northern Idaho.

Information on the occurrence of atlatl weights elsewhere in Idaho is extremely meagre. During the past year two examples have been brought to my attention. One of these (not illustrated) is an elongated, sharply bi-pointed, boat-shaped form with slightly upturned ends and a flat base. It measures 8.6 x 2.2 x 1.5 cms and is made of a soft, black, micaceous stone. Except for the fact that it lacks terminal notches or other indications of the method of lashing it to a throwing board, its size and shape is comparable to that of the Type II weights described by Butler and Osborne (**Ibid:** 217-218). This specimen was collected in 1959 by Mr. O.D. Crippen of Salmon, Idaho, from a site at Hood Gulch in the Salmon National Forest, just south of the Continental Divide in east-central Idaho. A second, better made Type II weight (Fig. 1) was collected in 1942 by Mr. and Mrs. R. M. Carter of Pocatello, Idaho, from a blow-out site a few miles north of the Snake River in southeastern Idaho, at a locality that has yielded a number of classic "Early Man" points (Folsom, Scottsbluff, etc.) as well as more recent types of points. This specimen is made of a black banded, green argillite, measures 11.0 x 3.0 x 2.5 cms, and weighs 117 grams. There is a narrow groove or notch over either of the narrow ends, and the base is definitely concave. Thus far, there have been no reports of Type III weights occurring in Idaho.

In southeastern Oregon, only Type II weights were reported previously (Butler and Osborne 1959: 218). Since then a small, loaf-shaped Type IIIa weight from the west shore of Summer Lake has been illustrated in a recent issue of the Oregon Archaeological Society publication, **Screenings** (Vol. 9, No. 11, November 1960: Fig. 4). Unfortunately, there are no data given on its cultural associations. This is also true of an excellent specimen from Alaska. which Cressman has illustrated in his "Cultural Sequences at the Dalles, Oregon" (Cressman 1960: Fig. 58, lower left hand artifact). This specimen appears to be identical in

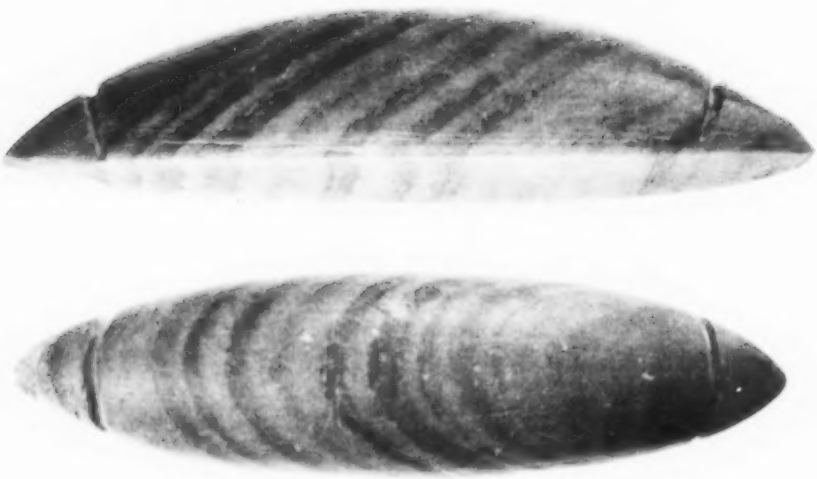

Fig. 1. Argillite Atlatl Weight from Southeastern Idaho (R. M. Carter collection). Upper, side view; lower, view of top. Length 11.0 cms.

every respect to two Type IIIa weights from Wakemap Mound, (**v.** Butler and Osborne, 1959: Fig. 2, l - m), a large, multiple habitation site at The Dalles. The latter are from an early village level which has been radiocarbon dated as 9th to 14th Century A.D. in age (**Ibid:** 220). The material culture from this village may have ties with the Northwest Coast. It would be interesting to know what the associations, provenience, and locality of the Alaskan specimen are and whether or not this information would shed light on the atlatl weight problem in the Northwest as a whole.

Apparently there is still some misunderstanding and general lack of acceptance of the hypothesis that the objects described by Butler and Osborne are indeed atlatl weights. Arguments against this hypothesis tend to fall into two broad classes: (1) there is no real basis for calling these objects atlatl weights, which implies either (a) that none have ever been found in indisputable association with throwing boards or (b) that, even if they had been found in association with throwing boards, they may not have functioned as weights or balancing devices; and (2) that although these objects may have served as atlatl weights in certain areas or at certain time levels, the specimens which have been found in the Northwest may represent some kind of vestigial, decorative, or ceremonial artifacts and therefore would not, in fact, have served as weights nor indicate the presence of the throwing board, as was implied in the Butler and Osborne paper.

Part of the first argument is easily resolved, for the evidence is already at hand and has been for a good many years. For example, Kidder and Guernsey (1919: Pl. 83) illustrate several weights and throwing boards which were found in indubitable association in Basketmaker II sites in northeastern Arizona. At least one of these weights closely resembles the earlier Type IIIa weights found in the Northwest (e.g., Butler and Osborne 19 9: Fig. 2, f). An atlatl, complete except for the finger loops, with a gypsum weight lashed to the back of it with sinew, was recovered from the Baylor Rock Shelter, Culberson County, Texas, in 1938 by an amateur and later described and illustrated in **American Antiquity** by Fenenga and Wheat (1940: 221 - 223 and Fig. 9). Recently, Peets (1960) has experimented with a replica of this atlatl and has concluded that "balance on the hand is the real purpose of atlatl weights, and no valid judgment of the importance of the quality (of the balance on the hand - B. R. B.) is possible unless certain contingencies of actual use are simulated" (**Ibid:** 110). Experiments of the type that Peets has carried out are, in my estimation, one of the most convincing methods of resolving the latter part of the first argument.

The second type of argument is more difficult to deal with. It should be pointed out, however, that the alternative hypotheses (**i. e.,** that these are merely decorative, ceremonial, or vestigial objects) are far more difficult to support with concrete evidence than the Butler-Osborne hypothesis. Ideally, with reference to the Butler-Osborne hypothesis, we need only find a con-

sistent association of the various types of weights with throwing boards at various time levels in the Northwest. Since the wooden throwing boards are perishable, and found only under exceptional circumstances, we might consider other material culture traits which could be expected to reflect the presence or absence of the throwing board, such as the overall size and weight of projectile points in a given sequence (**v.,** Fenenga 1953). For example, Caldwell's analysis of the projectile points from Wakemap mound (Caldwell 1956), made at a time when he knew nothing about the presence of atlatl weights at the site, indicated that there was a break in the size and weight range of the projectile points at a certain level in the mound. The points above this level tend to be much smaller and lighter than those found below this level. Atlatl weights were subsequently discovered in the lower level (Butler and Osborne 1959: 220), but not in the higher levels, which dated later than the 14th Century A.D.

Inherent in these various arguments against the atlatl weight hypothesis is a rather strong tendency to overlook the possible significance which these objects may have with reference to the culture history of northern North America. The spatio-temporal distribution of the types of atlatl weights described by Butler and Osborne appears to indicate that there were important cultural ties between the Northwest and other areas, such as the Eastern Woodlands, California, and the Southwest. If this is true, then these other areas may have made significant contributions to the development of Northwest cultures, particularly after the period of 1000-500 B.C., when atlatl weights are believed to have appeared in the Northwest (Butler and Osborne 1959: 220).

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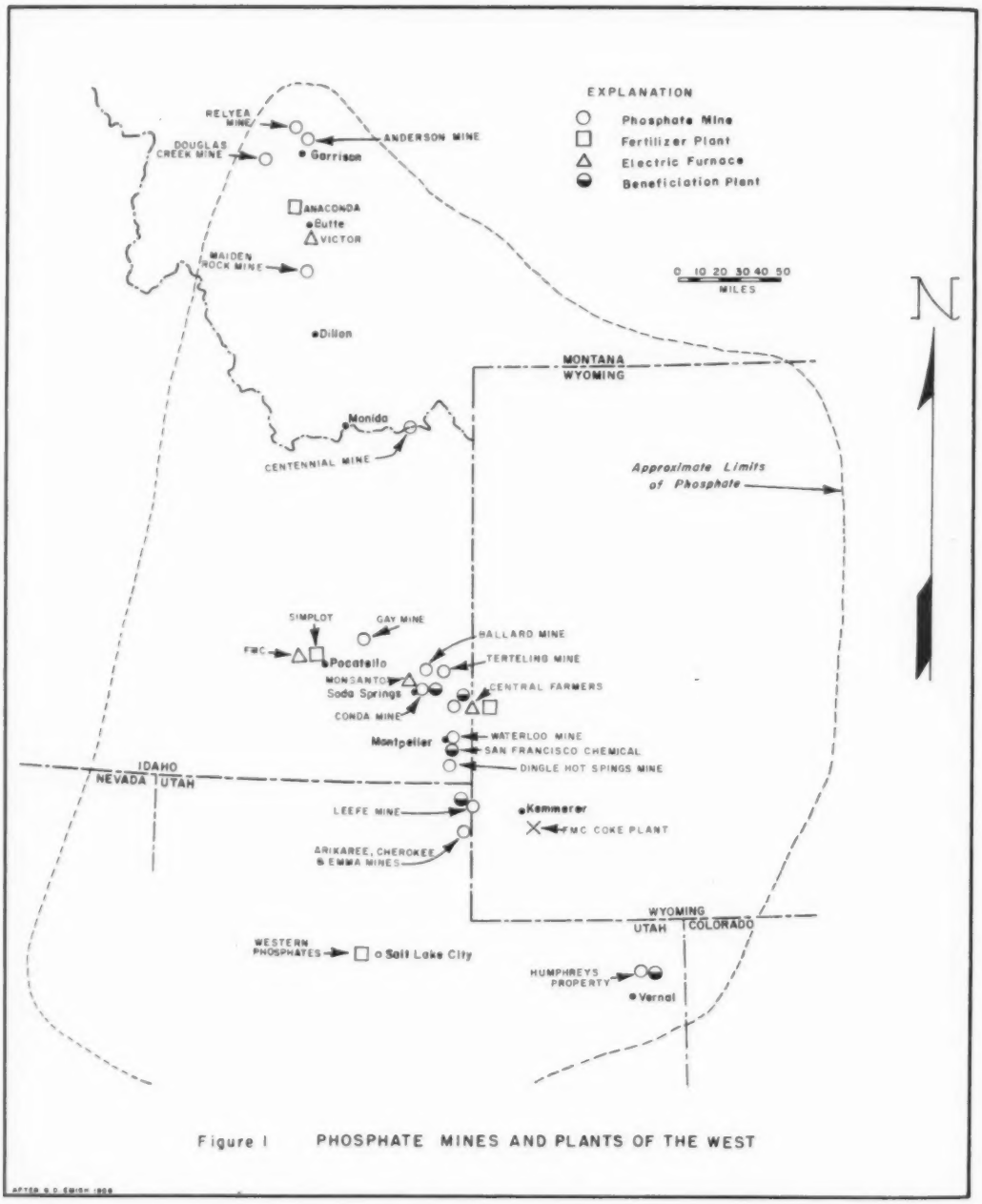

Figure 1 PHOSPHATE MINES AND PLANTS OF THE WEST

AFTER G.D. EMISH 1968

A Brief Survey of the Western Phosphate Industry

by V. E. Larsen

Abstract

In 1945 the annual production of the western phosphate industry was valued at a few million dollars; in 1959, the annual value of the finished product increased to an estimated 130 million dollars.

During 1959 open pit and underground mines in Idaho, Montana, Utah, and Wyoming produced about 2½ million tons of phosphate rock. More than one half of this tonnage was used in electric furnaces; the remainder was used for various types of phosphate fertilizer.

Much of the ore is mine run, but there is an increasing trend toward beneficiation in order to utilize lower grade material that is not suitable for direct acidulation for fertilizer or for electric furnace feed.

Introduction

In these days of depressed metal prices, mine closures and increasing competition from foreign ore, the industrial minerals have been one of the few bright spots in Western mining. Phosphate production from Western mines (see Figure 1) has doubled during the last decade and should show a healthy increase during the coming sixties.

Stratigraphy

The economic phosphate deposits of the West are confined to the Permian Phosphoria Formation which has an areal extent of about 135,000 square miles. The U.S. Geological Survey has done extensive stratigraphic work in the Phosphoria, and has divided it into many units. (See McKelvey and others, 1959; Cheney, 1957 and 1959). However, the brevity of this paper precludes any involved discussion of the stratigraphic nomenclature and only a general lithologic section of the Gay Mine will be presented. (See Figure 2). The Gay Mine is a joint operation between Simplot and Food Machinery and Chemical Corporation and is located in section 27, T. 4 S., R. 37 E., Bingham County, Idaho.

The upper member of the Phosphoria Formation is the Rex Chert which consists of tan to dark gray cherty mudstone or shale. The Meade Peak Phosphate Member underlies the Rex Chert and consists of carbonaceous siltstone and phosphatic shale, minor limestone and dolomite with a high grade oolitic phosphate bed at the base of the member. The underlying Grandeur Member consists of sandy limestone with a few thin chert beds at the top and grades stratigraphically downward into limestone. The upper siliceous limestone of the Wells Formation of Mansfield (1927, p. 72) has been assigned to the Grandeur Member of the Park City Phosphoria Formation (McKelvey and others, 1959, p. 15).

Exploration

The phosphatic member of the Phosphoria Formation is non-resistant, and outcrops are extremely rare. Therefore, it is necessary to trench or drill to determine the grade and thickness of the phosphate units. Trenching is useful to delineate the contracts of the phosphate and to expose the section for measuring and sampling. Frequently, however, the phosphate is covered by 25 to 200 feet of Quaternary and Recent sediments which commonly limit the usefulness of trenching. A small rotary drill rig using air and/or water as a circulating fluid proved to be an excellent tool for uranium exploration and was successfully adapted for phosphate exploration. Under average conditions at the Gay Mine the drilling rate will approximate 500 feet per day. Samples are caught at five-foot intervals or at lithologic breaks, split in the field, and stored in sample bags or quart ice cream cartons. The cartons are surprisingly durable and quite inexpensive.

The drill holes are laid out on a grid pattern that is determined by the size of the area, the structural complexities, and the amount of money available for a drilling program. A typical grid pattern might have 300-foot centers on strike and 100-foot centers down dip. After a mining panel has been selected it is usually necessary to drill on closer centers to control grade and define faults and folds.

Grade

The grade of ore mined at different properties varies depending on the nature of the deposit and the ultimate use of the ore. At some operations it is possible to ship mine run rock that will average 31% P_2O_5 which is used for the manufacture of phosphate fertilizer and/or furnace grade shale (24% P_2O_5)—which is used in electric furnaces to make elemental phosphorus. At other mines the average grade of rock is lower and beneficiation is necessary to bring the rock up to acid grade and/or furnace grade specifications.

Mines & Mining

In 1959, open pit and underground mines in Idaho, Montana, Utah, and Wyoming produced an estimated 2,500,000 tons of acid grade and furnace grade phosphate. The major producers were J. R. Simplot, Monsanto, Central Farmers, San

Francisco Chemical, Victor Chemical, and Montana Phosphate Company.

Mining operations at the Gay mine near Pocatello, Idaho, are typical of open pit phosphate mines. At the Gay Mine, scrapers remove the overburden and mine and stockpile the mill grade shale. The furnace shale and the acid grade rock are mined by shovels which load the ore into trucks or belly-dump "wagons" which transport the ore to a tipple where it is crushed and loaded into gondola cars. In underground mines, top slicing, sublevel stoping and open stoping are used.

Beneficiation

The reserves of acid grade and furnace grade rock that can be shipped direct are being depleted and the importance of beneficiation is becoming paramount in the minds of phosphate producers. Some operators are beneficiating ore now and others are contemplating beneficiation in the near future. The use of beneficiation will result in several advantages — large deposits of low grade ore can be utilized, mining costs will be lower because less selective mining will be necessary and a beneficiation mill will provide plants a more uniform feed material.

The simplest method of beneficiation is sizing — either scalping off the large pieces of low grade material or screening the rock and discarding the fines which are low in P O . Calcining is used to oxidize the organic material associated with the phosphate in some deposits. Selective flotation is used by several operators to produce acid grade and furnace grade rock from lower grade material. Some research has been done on sink-float beneficiation using heavy media as magnetite or ferrosilicon.

Fertilizer Plants

In 1959, approximately one million tons of high grade phosphate rock (31% P O)—were used in the production of various types of phosphate fertilizer.

Super-phosphate is produced by the acidulation of phosphate rock and sulfuric acid; phosphate rock and phosphoric acid are reacted to make triple super-phosphate, and a few plants make ammonium phosphate fertilizers. Fertilizer plants are located at Anaconda, Montana (Anaconda Company), Pocatello, Idaho (J. R. Simplot), Georgetown Canyon, Idaho (Central Farmers), and Garfield, Utah (Eastern Phosphate, Inc.).

Electric Furnaces

In 1959, approximately one and one-half million tons of phosphate rock were used in electric furnaces to produce about 140,000 tons of elemental phosphorus (P) with an estimated value of $52,000,000. The first producer of elemental phosphorus in the West was FMC's Mineral Products Division (Westvaco) which has four furnaces at Pocatello, Idaho. Monsanto has two furnaces at Soda Springs and Victor Chemical has two furnaces at Silver Bow near Butte, Montana. Central Farmer's operation in Georgetown Canyon went on stream in 1959 and has one furnace in operation.

The electric furnace process uses phosphatic shale (24% P O), silica, and coke. The furnace change is melted by carbon electrodes; the coke acts as a reducing agent, and the P is volatilized, condensed, and collected under water as a liquid. The silica combines with the calcium and iron in the ore and, is tapped from the furnace as a molten slag. The P is used to make organic and inorganic chemicals, and burned to produce phosphoric acid which is used to make triple superphosphate.

New Developments

The newest addition to the list of phosphate producers is the Central Farmers operation in Georgetown Canyon near Montpelier, Idaho, which went on stream in 1959. The operation is complete, and includes an open pit mine, a beneficiation plant, a fertilizer plant, and an electric furnace.

Western reserves of coking and semi-coking coal are limited. Coke and coking coal must be shipped in from the East and South with an extremely high freight burden. Producers of elemental phosphorus (which requires large amounts of coke) and western steel plants are watching closely the new Food Machinery coke plant near Kemmerer, Wyoming. The plant, which will be on stream, in 1961 will make coke from bituminous and semi-bituminous coal. If the process is as successful as pilot plant operations indicate it will make possible the utilization of huge reserves of western low grade coal and open up new possibilities for industrial expansion in the West.

For more than forty years the large Humphrey's phosphate deposit on the south flank of the Uintas near Vernal, Utah, has lain dormant because the ore was too low grade to be used commercially. Recently, San Francisco Chemical Company acquired the property and devised a suitable method to upgrade the ore to acid grade specifications. Construction of the beneficiation plant was started in April, 1960, and completed in 1960. Acid grade concentrates are trucked to the Western Phosphate Inc. plant at Garfield, Utah. Eventually, a fertilizer plant and a electric furnace may be constructed on the property.

Bunker Hill has built a fertilizer plant near Kellogg, Idaho, using sulfuric acid produced from its zinc smelter. Ore will be obtained from company mines in western Montana.

Food Machinery and Chemical Corp.
Pocatello, Idaho

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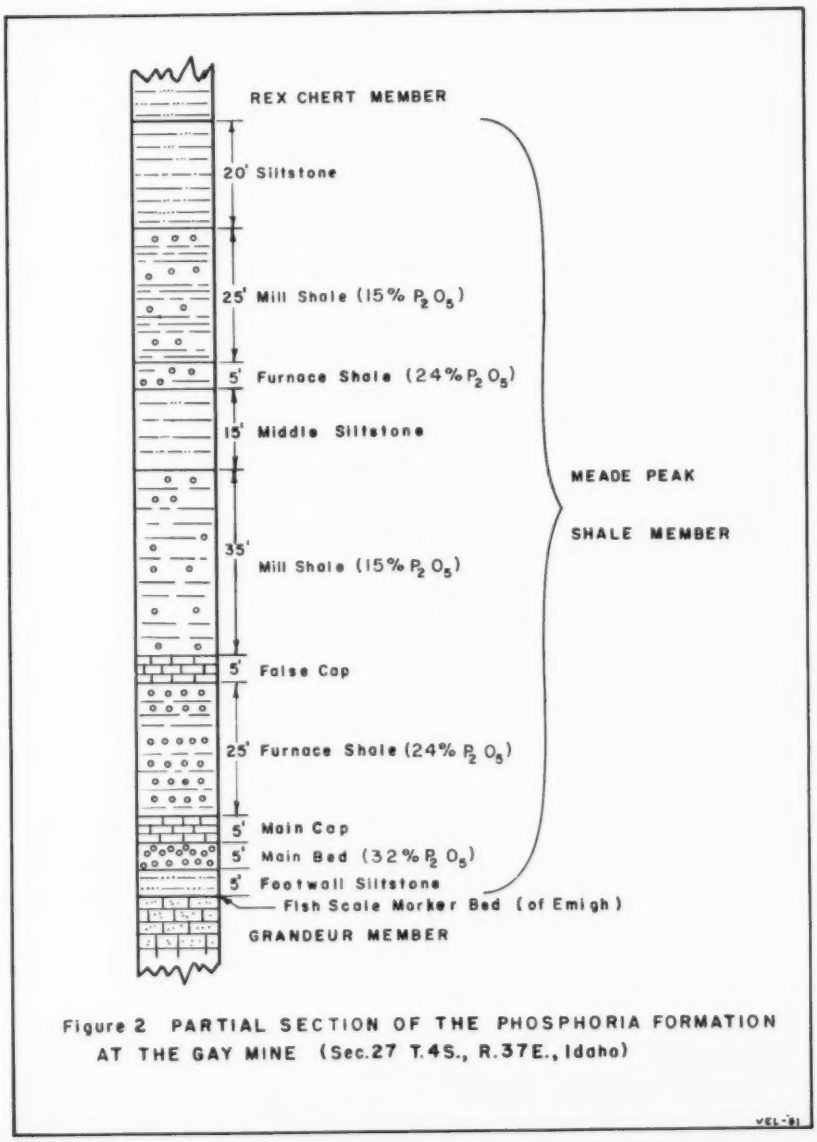

Figure 2 PARTIAL SECTION OF THE PHOSPHORIA FORMATION AT THE GAY MINE (Sec.27 T.4S., R.37E., Idaho)

GHOST
TOWN DRUG STORE
THE POST OFFICE DRUG STORE WAS THE LAST DRUG STORE TO REMAIN IN THE ONCE PROSPEROUS MINING TOWN OF SILVER CITY, IDAHO. IT WAS OPERATED JOINTLY BY ASHER A. GETCHELL, HOLDER OF IDAHO STATE PHARMACIST'S LICENSE 1, AND HIS BROTHER M. M. GETCHELL, WHO FOUNDED THE STORE IN THE EARLY 1890'S.

Fig. 1. The Museum's New Exhibit Case in the College of Pharmacy Building, Idaho State College Campus. (Note: pair of fluorescent tubes showing on the ceiling of the case are reflections from hall lights.)

The Idaho State College Museum's Pharmacy Exhibit Area

by Glenn R. Downing

The College of Pharmacy has recently designated a new area on the main floor of the Pharmacy building for use by the Idaho State College Museum. The area consists of a large and small case, the larger to be used for exhibits on pharmacy, history of medicine, and other subjects, while the smaller as an "advertising" case for the Museum. The small case contains a large "free-form" panel on which is given the Museum hours and location. It will have frequent changing exhibits consisting generally of single objects which can be rotated easily and frequently. Such a practice is already being carried on in the Student Union Building where the Museum has an exhibit case for "advertising" the Museum, and in which objects are changed every week.

The large area has the dimensions of 11.5 feet wide, 6.5 feet high from the case base, and 3.5 feet deep. The case base is 25 inches from the floor This larger area is shown in the accompanying figure (Fig. 1). The small area is the same height and depth, but only 45.5 inches wide. Both areas have pegboard masonite backgrounds running from the ceiling to base, and both have large double doors for easy access when installing large items and panels. Both areas are painted a light beige color, including the base. Lighting consists of two eight-foot G.E. Power-Groove tubes in the large case, and two four-foot tubes in the small case. The first tube is installed next to the front ceiling beam, which conceals it; and the second tube is installed close to the first, but separated with a tin shield which cuts off the light from the viewer's eyes and at the same time reflects the light to the case back. The tin shield is painted the case color. Electric strip moulding is mounted on the case base next to the glass front, so that spot lights can be plugged in when needed.

The first exhibit in this new exhibit area is entitled "Ghost Town Drug Store". It contains relics from a drug store which operated in the heyday of the old mining town of Silver City, Idaho. The relics include prescription files, drugs, patent medicines, pill-making machine, advertising materials, and numerous other items.

The main title for the exhibit was made by using 4.5 inch cut-out letters painted a dark brown and mounted on a long panel painted the case color of light beige. To the left, a cut-out silhoutte map of Idaho was mounted at an angle away from the background. It was painted a dark brown to match the title lettering. The location of Silver City was marked on the map with white Art-type. On the right of the main title a large picture of the old prescription shelves was mounted at an angle out from the background. Another large picture showing the exterior of the old drug store was mounted on the left center of the background. Both photographs were first dry-mounted on light green panels. This green framing added a touch of color to the exhibit, since the relics, in general, were of a drab color.

To the right center, on a panel painted the case color of light beige, was mounted the main text with lettering of 1.25 inch cut-out letters painted a dark brown. No labels for individual items were used in the exhibit.

A complete summary of the Museum expedition to Silver City, together with a photograph showing the loading of the relics in front of the old drug store, was printed in one of the college bulletins. A clipping of this was mounted on a green background and placed on a plexiglas stand on the extreme left of the case next to the glass. Thus the clipping is in an inconspicious place, yet is available for anyone who wishes to pursue further the information given about the old drug store and the Museum expedition.

The relics were divided into two categories when the exhibit was planned: the old prescription files, writing stand, documents and ledgers in one category, and the drugs and patent medicines in the other.

A large, low platform eight inches high, and irregular in form, was constructed of quarter-inch Upson board, with the curved front made of Upson Easy Curve board. This platform was used for holding the writing stand and ledgers. A vertical panel 16 inches high of Celotex mounted on its own base was used as a background for hanging two of the prescription files.

All of the "props" were constructed so the exhibit can be taken apart easily in order to get into the case when needed for changing light tubes. Thus the shelving for holding the drugs and patent medicines consisted of wooden boxes stacked two high. Two were installed against the background, and four set at an angle on the right for holding the larger bottles of drugs. All of the boxes, as well as the rest of the "props", were painted the same color as the case.

A very low, oblong, circular platform set up on one-inch boards, was placed on the case base on the right center to hold a pill-making machine together with some of the old pill boxes and envelopes. Clay imitation pills were rolled with the machine to suggest its original use.

This new exhibit area is another extension of the museum on the college campus — a practice which we feel attracts the attention of the students to the importance of the Museum and its program in the life of the college and the community.

Idaho State College Museum

NOTES ON CONTRIBUTORS

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GLENN R. DOWNING is Chief Curator of the Idaho State College Museum. Before taking this position, he was associated with several museums in the Midwest. His B. A. and M. A. degrees were earned at the University of Iowa.

RUTH GRUHN is a Research Associate in Archaeology of the Idaho State College Museum. She has worked on expeditions in several areas of the Northwest, and was for two years in charge of the joint I.S.C. Museum — Peabody Museum (Harvard University) expedition to Wilson Butte Cave. She has recently received her Ph. D. in anthropology from Radcliffe College.

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